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GENERAL AND MISCELLANEOUS

8325 BNL-571
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT FOR JANUARY 1–APRIL 30, 1959. F. Maslan, ed. 99p. OTS.

Reactor Chemistry. In two separate runs, the chemical activity coefficient for Th in dilute Bi solutions at 500°C was found to be 3.3×10^{-9} by the galvanic cell technique. In similar experiments, preliminary measurements suggest that the free energy of formation of ThC_2 is about −32 kcal/mole at 780°C. In LMFR, the extent to which Sm adsorbs on core graphite was investigated. A potentiometric titration method was developed for the determination of small concentrations of U^{+++} in chloride melts. On the basis of preliminary results, there appears to be a considerable mutual solubility effect between Zr and Ru in Bi solutions. Salt Corrosion Studies. Sixteen different metals and alloys have been tested in rocking-furnace experiments to determine their suitability for constructing fuel-salt extraction columns. Removal of Fission Products Volatile. The behavior of fission product iodine and xenon in LMFR fuel systems was studied. Insoluble Slurry Work. In in-pile experiments it was indicated that appreciable adsorption of fission gases on ThO_2 particles dispersed in Bi may occur and present an operational problem. Metallurgy. $ThBi_2$ particle growth inhibition by Te results in an increased viscosity of an as-prepared $ThBi_2$-Bi slurry because of the greater number of particles <10 μ in diameter. Fluidity can be increased by heat treatment. The minimum amounts of Mg or Zr required to disperse ThO_2 powder appear to be independent of the ThO_2 mass and particle surface area. A reaction is indicated with an unknown impurity present in the Bi to $\approx 6 \times 10^{-6}$ gram equivalent weights per g Bi. Mg and Zr additives lower the contact angle between ThO_2 and liquid Bi and improve wetting of the ThO_2 powder. At present corrosion of the welds appears to be the principal difficulty with respect to LMFR container materials. Experiments have shown that nitrogen in steels combined as AlN is not available for film formation. ZrN films can spall in areas where they are thickest, and can be reformed on these areas. The corrosion resistance of a 2¼ Cr–1 Mo steel decreases as its carbon content decreases below 0.10%. The low C content of weld rod metal coupled with C and Cr segregation during welding may be responsible for the preferential attack observed. The addition of 1 wt.% Mg in Bi partially eliminates the reduction in the solubility of U caused by Zr. The addition of 1.5 wt.% Cs increases the solubility of U in Bi by 25 to 50% between 400° and 500°C. A maximum in the solubility of U in Bi containing 2 wt.% Na was found at 400° to 500°C. The solubility of Zr in Pb-Bi alloy (Pb/Bi = 1.04) was found to be more than 10 times lower than in Bi. Zr in Bi has a mutual solubility product relation with Rh and Ru. Reactor Theory. Several studies in support of the design of the BNL high flux epithermal reactor were completed. Neutron spectra were calculated for water containing various concentrations of boron. Calculations were completed of resonance capture in 0.6-in.-diam uranium rods in water. A statistical evaluation of fission product absorption cross sections was completed. Experimental Reactor Physics. The final value of the buckling of the "19" stack was measured and was found to be $(6.24 \pm 0.31) \times 10^{-4}/cm^2$. Reactor Evaluation and Advanced Design. Work continued on organic cooled reactor systems. Work was initiated and completed on a study of organic reactors for maritime use. Heat Transfer. Heat transfer coefficients, under improved test conditions, have been measured for parallel flow of Hg through staggered tube banks. Fluoride Volatility. Development studies continued on the nonaqueous NO_2-HF system for reprocessing fuel elements. Short-term Monel corrosion rates for a complete processing cycle involving dissolution, evaporation, drying of the salt, and opening of the system to the atmosphere have been as high as 10 mils/month at 400°F. The dissolution of sintered ThO_2 in NO_2-HF solution was not successful. In further work on the extraction of Pa^{233} from irradiated ThF_4 powder, a series of semicontinuous contactings with NO_2-HF solution resulted in the extraction of 32% of the Pa activity. Studies on the ignition and detonation of U in BrF_3 solutions were continued. Mechanical Engineering. Work started on the so-called reference design B of the Brookhaven beam research reactor (also known as the high flux epithermal reactor). Special Radioisotope Development. The extent of adsorption on Y^{90} on Dowex-1 anion exchange resin appears to be a function of the per cent cross-linkage of the resin. A chromatographic method of separating As^{72} from Se^{72} using a Dowex-1 resin gives satisfactory yields and probably satisfactory purities, although the method is undesirably complicated for general laboratory use by relatively unskilled technicians. Five methods for the separation of Ca^{47} from Ti^{50} were studied during the quarter. Production of millicurie amounts of Cu^{67} from $Zn^{67}(d,2p)Cu^{67}$ looks possible, and an electrolytic separation of the product appears promising. Radiochemical Analyses. Investigation of the extractability of Bi by triisooctylamine as a function of Cl^- concentration was studied. A direct reader attachment and a photographic technique were developed for simultaneous spectrographic determination of seven elements in bismuth or eutectic salt. (For preceding period see BNL-554.) (T.R.H.)

8326 NYO-2977

National Industrial Conference Board, Inc., New York. RADIOISOTOPES IN INDUSTRY. John J. McMahon and Arnold Berman. [Nov. 1959]. 136p. Contract AT-(30-1)-2135. OTS and NICB.

The principal techniques and uses of radioisotopes by industry are reviewed. Types of savings being realized through applications of radioactive isotopes are discussed. Industrial experiences are described in which radioisotopes are used in studies on metabolism; the efficiency of detergents; measurements and control of density; control of levels in process vessels; inspection of plant equipment; studies on crude petroleum and natural gas; screening and assaying new drugs; inspection of equipment and research applications by electric and gas companies; inspection of castings and welds in electrical machinery; research on electronic components and accessories; research and testing procedures by engineering and architectural service industries; radiographic inspection of castings, forgings, and weldments for flows or imperfections; research in the food industry; the measurement and control of ore slurries in the mining industry; nondestructive testing of welds and castings and measurement of performance of nonelectrical machinery; measurement and control of the basis weight of paper and paperboard; research studies to develop new and better products and improve petroleum refinery operations; measurements and control of the thickness of plastic materials and synthetic resins; inspection of castings for flaws and thickness measurements in the primary metals industry; measurements and thickness control in the rubber industry; measurements of the thickness of coated abrasives and the density of cement slurries in the stone, clay, and glass products industry; measurement and control of the thickness of coatings applied to fabrics in the textile industry; gages to control the density of tobacco in cigarettes; and the inspection of castings, forgings, and weldments by shipbuilding firms and others engaged in various phases of the transportation equipment industry. Problems encountered in industrial uses of radioisotopes are discussed. (C.H.)

8327 WT-347

Office of the Quartermaster General, Washington, D. C. CLOTHING DECONTAMINATION AND EVALUATION OF LAUNDRY METHODS. Donald C. Hughes, Alfred H. Parthum, Jr., Howard James, and John C. McWhorter, Jr. Apr. 1, 1952. Decl. Oct. 16, 1959. 81p. Project 6.7 [of] OPERATION JANGLE. OTS.

The over-all objectives of this project encompassed testing the suitability of standard and special laundering methods and standard equipment for field decontamination of clothing; evaluating the contaminability and decontaminability of selected fabrics; and testing of experimental clothing monitoring instruments. Garments and fabrics contaminated by controlled methods were used during the operation for testing the equipment and evaluating fabrics and formulae. Standard Army laundering methods and equipment, including wooden washers, were effective for decontaminating clothing in the field. A decontaminating laundry formula employing citric acid and tartaric acid followed by either an organic or inorganic chelating agent results in a higher degree of decontamination than other formulae tested. The standard Quartermaster Corps mobile field laundry formula resulted in satisfactory decontamination with the type of soil and activity encountered and the cost of supplies is approximately one-tenth as much as the special formulae. Woolen garments and fabric swatches were decontaminated by laundering as readily as cotton or synthetic fabrics. Clothing monitoring instruments under development appear suitable for monitoring clothing under field conditions to determine the degree of contamination both before and after processing. (auth)

8328

ADVANTAGES OF HIGH-THRUST SPACE VEHICLES. Maxwell W. Hunter and Joseph M. Tschirgi (Douglas Aircraft Co., Inc., Santa Monica, Calif.). Astronautics 5, No. 2, 28-9; 99-102(1960) Feb.

A comparison is made between a high-thrust vehicle, a nuclear rocket using hydrogen as a working fluid, and a low-thrust vehicle, a reactor-turbine-generator electrical propulsion vehicle, relative to useful payloads, power potential, shielding problems, and maximum velocity. (C.J.G.)

8329

RADIOISOTOPES AS SOURCES OF HEAT. Stanley H. Clark (Medical Nuclear Consultants, Inc., Washington, D. C.). Atompraxis 6, 8-11(1960) Jan. (In English)

The thermal power generated from beta- emitting and alpha- emitting radioisotopes is compared with various transuranic elements which decay by spontaneous fission. The production of the transuranic isotopes is reviewed with particular attention given to the build-up of various transuranic isotopes that would offer useful power generation by their own decay. Comparison of the decay curve of Cf^{254} and the light decay curve of the supernova I.C. 4182 illustrates the formation of at least one of the spontaneously fissioning isotopes in a stellar process. Further discussion of the so-called "γ-process" describes a possible method of build-up of very high atomic weight elements. This process is suggestive of the ultimate approach necessary for synthesis of the spontaneously fissioning isotopes. The power output from californium-254 is shown to be of the order of 1 thermal watt per gram of Cf^{254}. The prospect for obtaining significant quantities of such high specific power materials depends upon the urgency and uniqueness of applications which are found for this highly concentrated form of energy. (auth)

8330

FUTURE OF THE ACTINIDE ELEMENTS. William W. T. Crane (Martin Co., Baltimore). Atompraxis 6, 12-15(1960) Jan. (In English)

A summary of a program, initiated by the United States Atomic Energy Commission to make sufficient quantities of these elements available for basic research, is reviewed. Some of the experiments planned to advance our knowledge of the basic properties of these elements are discussed. The need for trans-plutonium elements in the space program to supply auxiliary power for space missions is reviewed. This need can be answered using isotopes such as curium-242, curium-244, and plutonium-238. The applications that need these isotopes today are hampered by their present low availability, but with sufficient foresight, these isotopes can be made available for the future. (auth)

8331

DEVELOPMENT OF INITIATIVES AND PROGRAMS IN THE FIELD OF NUCLEAR ENERGY IN ITALY. Basilio Focaccia (Comitato Nazionale Per Le Ricerche Nucleari, Milan). Rend. AEI (Venezia) 2p.(1959) Sept.-Oct. (In Italian)

The story of nuclear research in Italy is reviewed with emphasis upon the activities and programs of Italian industry for nuclear power production. (auth)

8332

PROCEEDINGS OF TECHNICAL MEETINGS. Washington,

D. C., United States Atomic Energy Commission, 1959. 31p. (Free-TISE).

During the past decade, meetings, conferences, and symposia have become important mechanisms for the exchange of information on virtually every aspect of nuclear science and technology. This catalog lists and describes proceedings of meetings in which the AEC or its contractors were sponsors, co-sponsors, or major participants. (W.D.M.)

BIOLOGY AND MEDICINE

General and Miscellaneous

8333 AD-218538

Army Medical Research Lab., Fort Knox, Ky.

PROGRESS REPORT [FOR] JULY 1, 1958–JUNE 30, 1959. 80p.

Activities in investigations of biological and medical aspects of ionizing radiation are reported along with research on radiation and thermal burns, nutrition, and environmental physiology. Psychophysiological studies are described, and investigations of biomedical aspects of missile transport are outlined. (J.R.D.)

8334 AD-220364

Stanford Research Inst., Menlo Park, Calif.

RADIOACTIVITIES PRODUCED IN FOODS BY HIGH-ENERGY ELECTRONS. Report No. 6 (Progress) for November 15, 1958 to January 14, 1959. Richard A. Glass. Feb. 15, 1959. 17p. SRI Project No. SU-2424. Contract DA-19-129-QM-1100.

Additional information was obtained on characteristics of radioactivity production from a series of irradiations of aqueous solutions of food elements. Theoretical calculations of radioactivity production and preparations for irradiations and radioactivity measurements of container materials were continued. (C.H.)

8335 AD-220828

California Packing Corp., San Francisco.

RADIATION STERILIZATION OF CANNED FRUITS AND VEGETABLES. Report No. 2 (Progress) [for] November 1, 1957–January 31, 1958. Robert A. Gillies. 31p. Project No. 7-84-01-002. Contract QMR D(Natick) No. 81.

Results are presented from an evaluation of the wholesomeness, flavor, color, odor, and acceptability of irradiated peas, spinach, and peaches stored for various time intervals after treatment. (C.H.)

8336 AEC-4665

Sloan-Kettering Inst. for Cancer Research, New York.

BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Semiannual Progress Report [for] Period: May 1, 1959–October 31, 1959. Dec. 1, 1959. 57p. Contract AT(30-1)-910. OTS.

A list of publications during the period and manuscripts in press is included. Progress is reported in the following studies: the electron spin resonance of free radicals in certain polycyclic hydrocarbon compounds which are carcinogenic, chemotherapeutic, or which have been irradiated; metabolic studies with calcium-45 and calcium-47 in bone disease; development of a whole-body scanner to improve resolution in isotope studies in patients; measurements of secondary electron spectra produced by internal isotope sources; in vitro studies of the metabolism of nucleic acid precursors in mammalian cells; developments of radioautographic technique for radioisotope tracer studies to demonstrate the incorporation of elements or compounds of biological interest into tissues; tracer studies in patients receiving labeled iodinated compounds, zinc-65, phosphorus-32, or gold-198; the design of a cesium-137 irradiator for laboratory animals, tracer studies on the growth inhibition of mammalian cells by selected antimetabolites; the interrelations of electrolyte balance and uric acid metabolism; a review of experience with iodine-131 in the treatment of hyperthyroidism and thyroid cancer; the synthesis of mercaptopurine nucleotides; physical and metabolic studies on purified ribonucleoprotein from rat liver; chemical studies of azapurine N-oxides; the direct thiation of heterocyclics with elementary sulfur; the physical characteristics of a number of nucleic acids; and the nature of the damage caused in mouse bone by exposure to 180 kvp x radiation. (C.H.)

8337 ANL-6049

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JANUARY THROUGH JUNE 1959. 101p. Contract W-31-109-eng-38. OTS.

A list of publications and papers submitted for publication during the period is included. Progress is reported in the following studies: a decay-time study of an irradiated scintillating solution; the development of methods and equipment for use in measurements of the cosmic-ray neutron background; the effects of the addition of various gases singly and in pairs to the inert gas argon on results obtained with the halogen-sensitive positive ion tube used to measure the concentration of tracers in atmospheric air; the calibration of a quantitative alpha-track autoradiographic technique; studies on radiation carcinogenesis of radium and thorium oxides in the human skeleton; development of a method for counting individual alpha activities in mixtures in which the component activities do not show considerable variation; a survey of natural radium-226 and radium-228 content in municipal water supplies; radioactivity measurements and dose calculations of soil collected at Argonne; the effect of various meteorological parameters on thermal conditions in the soil; design of an automatic data processing system which records data from nearly 200,000 meteorological measurements made annually; and studies on meteorological parameters affecting atmospheric diffusion of particles. (For preceding period see ANL-5967.) (C.H.)

8338 ORO-233

[Southwest Foundation for Research and Education, San Antonio].

FINAL AND COMPREHENSIVE REPORT ON WORK ACCOMPLISHED. N. T. Werthessen. Dec. 28, 1959. 16p. Contract AT(40-1)-1776. OTS.

Progress is reported in the development of methods for testing the effects of radiation in rats. The Dead Rat Day (DRD) method of computation can be considered as an arithmetical device which includes in one number the information obtainable from a lethal dose estimation and a mean survival time estimation. The method of DRD calculation requires a fixed period of observation of the group of radiated animals. Results from preliminary studies indicate that there are active and extractable substances present in pregnant cow serum, chick embryos, and embryo calf spleen that will protect rats from dying after radiation at dosage levels from 700 to 950 r. Problems involved in the isolation of these substances are discussed. (C.H.)

8339

SOME RESULTS AND PROSPECTS OF STUDIES IN COSMIC BIOLOGY. V. V. Parin, V. N. Chernigovskiĭ and V. I.

Yasdovskiĭ (Academy of Medical Sciences, Moscow). Izvest. Akad. Nauk S.S.S.R., Ser. Biol. No. 1, 3-18(1960) Jan.-Feb. (In Russian)

Dogs were subjected to a series of rocket flights at altitudes of 50 to 100.8 km and velocities of 4212 km/hr in a hermetic cabin and 700 to 1150 m/sec in a nonhermetic cabin. The dogs survived in the hermetic cabin and were rescued from the nonhermetic cabin by catapulting. The effects of accelerations, noise, and vibrations on various organs were studied from the moment of launching up to entering the orbit and during the prolonged absence of gravity during orbital flight. (C.J.G.)

8340

EMPLOYMENT OF THE METHOD OF SCANNING FOR MAKING MORE ACCURATE THE LOCALIZATION OF SPINAL CORD TUMORS. F. M. Lyass and B. I. Smagin. Med. Radiol. 5, No. 1, 51-2(1960) Jan.

The method of isotope myelography was utilized to establish a topical diagnosis of tumor of the spinal cord. An air-radon or air-xenon mixture 2.0 cm^3 in volume with an activity of 5 to 15 mc was used as a radioactive substance. After a tentative determination of the localization of the focus of elevated activity with the aid of a gamma-sound, a gammagram of this region was taken on a radiotopograph. The method of scanning will increase the accuracy of topical diagnosis of spinal cord tumors. (auth)

8341

CLINICAL-BIOLOGICAL USE OF SHORT-LIVED RADIOISOTOPES. L. Resegotti (Università, Turin). Minerva nucleare 3, 354-7(1959) Nov. (In Italian)

The possible uses in physiological and clinical researches of very short-lived radioisotopes is examined. The techniques for the determination of the extra- and intracellular spaces by means of Na^{24} and K^{42}, of the iron turnover by means of Fe^{52}, and of the thyroid function by means of I^{132} are described. The advantages of a nearby source of radioisotopes as regards the routine use of short-lived isotopes are stressed. (auth)

8342

EXPERIMENTAL STUDIES AND PRACTICAL POINTS OF VIEW ON THE STABILITY OF I^{131} LABELED SERUM ALBUMIN. Friedrich Arnold Gries and Cuno Winkler (Universitätsklinik, Bonn). Strahlentherapie 111, 56-64 (1960) Jan. (In German)

The stability of radioactive labeled serum albumin preparations is of great importance for all clinical and experimental studies dealing with these substances. Experimental studies were made about the effect of ionizing radiation on Risa-preparations of different origin and production. This seems to be of basic importance since every radioactive labeled protein is necessarily exposed for some time to the radiation of the labeling isotope. It was found that by ionizing radiation different, not protein bound radioactivity containing substances (so called free activity) can be isolated from Risa. Their formation was studied quantitatively and qualitatively. The cause of this observation was discussed. Possibilities to avoid interference of free activity during the use of Risa were discussed. (auth)

8343

THE MEASUREMENT OF NATURAL ENVIRONMENTAL GAMMA RADIATION. F. W. Spiers (Univ. of Leeds, Eng.). Strahlentherapie 111, 65-74(1960) Jan. (In German)

The natural radioactive content of the body, cosmic radiation, and environmental gamma radiation contribute to the natural radiation load of humans. Geiger-Müller counters, high pressure ionization chambers and dose films packed with scintillator foils have been used to measure the environmental gamma radiation, for which mainly the members of the uranium and thorium series and potassium-40 are responsible. The most exact performance was that of the high pressure chamber with which the other instruments have been calibrated. Necessary corrections being applied, the measurements agreed upon 80 to 90 mrad/a for the environmental gamma radiation in a Leeds laboratory. In different parts of Britain values between 21 and 300 mrad/a have been obtained. (auth)

8344

THE ABSORBED DOSE IN TISSUE FOR X-RAYS BETWEEN 10 kev AND 1 Mev AND THE TISSUE DENSITY. Herman Trübestein (Universitäts-Röntgeninstitut, Frankfurt am Main). Strahlentherapie 111, 122-38(1960) Jan. (In German)

Studies were made on the absorbed dose in tissue at a range of quantum energy between 10 kev and 1 Mev for x rays. An experimental arrangement for the determination of the tissue density was described. The density found by this method for different tissues was reported. (auth)

Biochemistry, Nutrition, and Toxicology

8345

DETERMINATION OF RADIOACTIVE SULFUR IN BIOLOGICAL MATERIALS. Henry Jeffay, Funso O. Olubajo, and William R. Jewell (Univ. of Illinois, Chicago). Anal. Chem. 32, 306-8(1960) Mar.

A method for the determination of sulfur-35 in biological tissues, fluids, extracts, and in organic compounds consists of oxidizing the sample to magnesium sulfate using a modified Pirie's reagent, dissolving the oxidation products in glycerol, and diluting with ethyl alcohol and N,N-dimethylformamide. Toluene containing scintillating phosphors is added and the samples are counted in a liquid scintillation counter (auth)

Fallout and Radiation Ecology

8346

RADIOACTIVE CONTAMINATION OF THE ATMOSPHERE AND OF THE SOIL. Dániel Vödrös (Central Research Inst. of Physics, [Budapest]). Energia és Atomtech. 12, 1-6(1959) Jan. (In Hungarian)

The properties of fission products from atomic and thermonuclear explosions are given. The world-wide distribution and dosage rate of radioactive fall-out are discussed. The more important radioisotopes and their maximum permissible concentrations in the human body are given. Libby's theory concerning the path of radioactive fall-out in the atmosphere is discussed, and the biological effects of radiation are reviewed. The hazards of runaway reactors are mentioned. (JPRS)

8347

CESIUM-137 UPTAKE BY PLANTS. FACTORS AFFECTING UPTAKE OF RADIOACTIVE CESIUM BY LETTUCE, GRASS, AND ALFALFA. Eric B. Fowler and C. W. Christenson (Los Alamos Scientific Lab., N. Mex.). J. Agr. Food Chem. 7, 847-9(1959) Dec.

Cesium-137 forms about 6% of the products released on fission. It enters the biosphere through fall-out and, hence, may find its way into plants and eventually into man. A

study of soil factors which affect the uptake of cesium and its possible control are reported. An increase in the available potassium in the soil is reflected by a decrease in the cesium-137–potassium ratio in the plant. Discriminations by plants against cesium-137 were in the range of 300 to 1400, dependent upon the soil and the plant. Discrimination may, in part, be related to the ion exchange capacity of the soil and in part to the exchangeable potassium content of the soil. Potassium fertilizers may decrease the cesium-137–potassium ratio in the plant, but may mobilize cesium in some soils and thus render it more available to the plant. (auth)

8348
DETERMINATION OF STRONTIUM-90 DISTRIBUTION IN HUMAN BONE. R. Björnerstedt and S. Häggroth (Research Inst. of National Defence, Stockholm). Nature 185, 366-7 (1960) Feb. 6.

Various methods for the determination of strontium-90 in bone samples are discussed. The feasibility of using autoradiographic methods for measurements of strontium-90 concentration in human bones is discussed. It is concluded that present levels of environmental strontium-90 in human bone as a result of fall-out would require an exposure time of one year to get a weak radioautogram. This assumes a concentration equivalent to one sunshine unit diffusely distributed and corresponds to the distribution in bones from children younger than fifteen years. (C.H.)

Radiation Effects on Living Tissues

8349 AECU-4689
Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.
ATTEMPTS TO DELINEATE INBORN ANEMIAS IN MICE. Progress Report [for] Period January 10, 1959 to January 31, 1960. Elizabeth S. Russell and Seldon E. Bernstein. Feb. 16, 1960. 22p. Contract AT(30-1)-1800. OTS.

Investigations related to determination of acute and long-term effects of whole-body irradiation on normal, slightly anemic, and severely anemic mice differing in W-series genes are reported. Continuation of implantation studies on blood-forming tissue is also discussed along with investigations of normal and W/W^v anemic mice to erythropoietin and to oxygen deprivation, improbability of pituitary defect in W-series anemias, studies of two types of jaundice in mice, and studies of specific radiation protection factor. (J.R.D.)

8350 ORO-230
[Miami. Univ., Coral Gables, Fla.].
A QUANTITATIVE STUDY OF THE EFFECTS OF RADIATION ON THE BLOOD CAPILLARIES OF NORMAL ANIMALS. Final Scientific Report. 8p. Contract AT(40-1)-1968. OTS.

Progress is reported on biochemical and histological studies on the nature and stability of intercellular cement substances, the role of inter-endothelial cell cement in relation to capillary permeability, and the effects of irradiation on the capillaries. A list of published articles based on results of the research is included. (C.H.)

8351 UCRL-9012
California. Univ., Berkeley. Lawrence Radiation Lab.
RADIATION EFFECT ON THE PERMEABILITY OF YEAST CELLS TO SODIUM AND POTASSIUM IONS (thesis). Kwan Hsu. Dec. 14, 1959. 101p. Contract W-7405-eng-48. OTS.

The movement of potassium ions from the cell to the outside medium, where the potassium concentration is lower than that inside the cell, is often considered as a diffusion process, whereas the movement in the opposite direction is defined as active transport. If the process is pure diffusion then the amount of potassium leakage should be expected to be a linear function of the cell surface area, and if there is energy involved in the active transport then the amount of potassium uptake is expected to be a linear function of the cell volume. Haploid, diploid, tetraploid, and hexaploid cells of a related polyploid series of yeast, Saccharomyces cerevisiae, were used in this study. The cells have characteristics surface areas and volumes, which increase with ploidy. The dry weight, the ash weight, the potassium, and the sodium contents of the cells were determined. The effects of nitrogen, oxygen, and dextrose on the uptake and leakage of sodium and potassium ions were studied with and without radiation. The potassium content of the cells was proportional to the dry weight, whereas the sodium content was proportional to the cell surface area with the exception of the haploid. The potassium leakage from the cells into the distilled water medium was found to be largely due to a diffusion process. The amount and the time rate of K^+ loss were larger and higher in cells of larger ploidy and with higher dose. The K^+ leakage was proportional to the cell surface area in both control and irradiated cells. In the presence of dextrose, active transport took place. The ratio of the potassium uptake by the hexaploid to that by the diploid was 3:1, the same as the ratio of their respective volumes. Oxygen also initiated the active transport process. Nitrogen did not have any obvious effect on the leakage and the uptake of potassium. The order of the radiosensitivity for potassium retentivity of cells of different ploidies does not follow the same sequence as that of lethality. Radiation up to 107 kr did not seem to impair the active transport process. In contrast to the behavior of potassium ions, loss of the sodium ions from the cells to the distilled water medium was not found to vary with dose. The outward movement of the sodium ions could not be explained as primarily due to a diffusion process. Nitrogen and dextrose did not have any obvious effect on the sodium leakage. Oxygen, however, was found to increase the rate of sodium leakage. (auth)

8352 JPRS-L-1173-N
BRAIN DEVELOPMENT OF ANIMALS IRRADIATED BY ROENTGEN RAYS AT EARLY STAGES OF EXTRAUTERINE LIFE. Ye. N. Kosmarskaya and Yu. I. Barashnev. Translated from Pediatriya 37, No. 11, 33-7(1959). 9p. OTS.

Reaction mechanisms involved in radiation damage to the developing brain were investigated following single whole-body 250 to 500 r doses of x radiation delivered to rats from one to 32 days of age. The animals lived for periods varying from five hours to three months following irradiation. Results showed that after birth active capillary multiplication processes occur in the cerebral hemisphere. During the first week from 230 to 450 newly-formed capillaries were found in each 100 microscopic fields. By the 30th day of extra-uterine life the number of new capillaries observed decreased to 20 per 100 microscopic fields. By the age of two months multiplication of the capillaries in the cerebral hemispheres stops. One of the causes of the growth disturbance in the cerebral hemispheres was observed to be the traumatizing effect of x rays on the multiplication of the cerebral capillaries. The characteristics of the response of the capillaries. The characteristics of the response of the capillary network to irradiation are described. (C.H.)

8353 JPRS-L-1174-N

PROBLEMS OF INHERITED AND NON-INHERITED ONTOGENETIC DISTURBANCES PRODUCED BY THE ACTION OF RADIATION. P. G. Svetlov. Translated from Vestnik Akad. Med. Nauk S.S.S.R. 14, No. 11, 29-37(1959). 16p. OTS.

The study of hereditary changes (radiomutations) arising as the result of the effect of ionizing radiation on the body should constitute one of the principal tasks of medical radiobiology. Since the minimum dose of x rays which injure embryos at critical periods of their development has been shown to be less than 30 r, the need arises for a prompt examination of the question of the danger of using procedures involving penetrating radiation in pregnant women. Although radiomutations are markedly different from qualitative ontogenetic changes in a number of characteristics, the problems of hereditary and non-inherited ontogenetic aberrations are inseparable from each other in view of the common mechanism by which they are effected in the phenotype. Further study of the physiological characteristics of embryogenesis is needed for the understanding of these mechanisms in the light of the theory of critical periods of development. The external developmental conditions can intensify or suppress the effect of hereditary factors. This gives us the basis for believing that the control of the manifestations of a radiation injury to the hereditary apparatus is possible in principle in a given individual. (auth)

8354

THE FLUORESCENCE OF THE EYE LENS IN RATS AFTER LOCAL ROENTGEN IRRADIATION. A SPECTROPHOTOMETRIC INVESTIGATION. Sven Elov Brolin and Hans Hammar (Univ. of Uppsala). Acta Ophthalmol. 37, 266-73(1959). (In English)

Cataract developing without a sign of regression in any observed case was induced in rats by means of roentgen irradiation confined to one eye. At the incipient stage of the development of cataract an increase in the fluorescence intensity was observed. Compared with the non-irradiated control eyes this amounted to 17%. At the mature stage, the fluorescence decreased by 31%. The increase as well as the decrease could be considered significant with P-values not exceeding 0.005. Only slight changes in the spectral distribution of the fluorescence could be observed. These were most pronounced at the mature cataract stage where the spectrum was displaced slightly towards shorter wavelengths. (auth)

8355

RED CELL REPOPULATION IN IRRADIATED MICE TREATED WITH PLETHORIC HOMOLOGOUS BONE MARROW. Joan Wright Goodman and Ray D. Owen (Oak Ridge National Lab., Tenn.). Am. J. Physiol. 198, 309-14(1960) Feb.

Marrow from normal homologous donors injected into heavily irradiated recipients results in a fast and permanent replacement of host- by homologous donor-type erythrocytes. Plethoric marrow, produced by artificial polycythemia, was capable of red cell repopulation of an irradiated homologous host. Repopulation was slower from plethoric than from normal marrow but reached 100% donor type and remained permanently at that level in all chimeras tested. There was a large decrease in hematocrit within the first 2 weeks after x-ray and bone marrow treatment in some, but not all, homologous combinations tested. In the combination studied most extensively, lethally irradiated $(C_3H \times 101)F_1$ receiving $(C_{57}L \times A)F_1$ marrow, the early anemia was considerably ameliorated by the use of plethoric in place of normal marrow. Possible mechanisms for these effects are discussed. It is suggested that plethoric marrow has a potential greater than that of normal marrow for producing blood platelets and can rapidly effect repair of capillary walls and thus reduce early red cell loss. (auth)

8356

RADIATION AS A CYTOGENETIC TOOL. J. B. Clark (Univ. of Oklahoma, Norman). Ann. N. Y. Acad. Sci. 81, 907-12(1959) Sept. 30.

Applications of radiation studies in cytogenetic studies of actinomyces are described. (C.H.)

8357

THE EFFECT OF X-IRRADIATION AND GLUCOSE ON BRAIN LIPID SYNTHESIS. E. Grossi, P. Paoletti, and R. Paoletti (Univ. of Milan). Arch. intern. physiol. et biochem. 67, 651-60(1959). (In English)

Rat x irradiation induces an increase in the rate of cholesterol and fatty acid biosynthesis from 1-C^{14} acetate, but has an inhibitory effect on brain lipid biosynthesis. Cholesterol and fatty acid biosynthesis from 2-C^{14} mevalonic acid is slightly increased by x irradiation in the liver, but is unchanged in the brain. Glucose added to the incubation medium increases the rate of lipid synthesis in the brain, to a greater extent than in the liver and has a marked effect on mevalonic acid incorporation into brain lipids. The effect of x irradiation is not modified by increasing the levels of liver and brain glucose. (auth)

8358

MAXIMUM PERMISSIBLE DOSE FROM THE VIEWPOINT OF RADIATION GENETICS. H. Marquardt (Universität, Freiburg i. B.). Atompraxis 6, 20-5(1960) Jan. (In German)

A brief survey is given of the problems of spontaneous and induced mutation in so far as they are important for an evaluation of maximum permissible doses and concentrations. The maximum permissible concentration for radioactive isotopes, the relative genetic effectiveness of various types of radiation, and the effect of slight doses of radiation have not been sufficiently verified from the experimental genetic point of view. The induced total mutation stress in a population includes chemically induced and radiation-induced mutations; at present, the approximate extent of the chemically induced mutation rate cannot even be estimated. Owing to recent findings in mouse genetics, the concept of the doubling dose has become problematical. Thus the genetic data necessary for dealing with special questions of borderline-dose determination are not available in sufficient quantity; therefore the geneticist cannot recommend any dose exceeding basic radiation below which a genetic risk can be excluded with certainty. Rather, each single factor should be kept as low as possible. In regard to the fate of future generations there is an urgent need of genetic research comparable with that in technology and atomic physics. (auth)

8359

VARIATIONS IN THE FIBULA AND TIBIA AFTER PARTIAL IRRADIATION OF THE LEG BUD OF A CHICK EMBRYO. Madeleine Kieny and Marguerite Schué (College de France, Paris). Compt. rend. soc. biol. 153, 1513-16(1959). (In French)

Experiments were made to test the hypothesis that the tibia and femur compete for material left intact after irradiation of the leg bud of chick embryos. Localized irradiation of forming tibia or fibula inhibits or prevents, selectively, the development of the irradiated bud without affecting differentiation of the protected bud. The two buds react differently to irradiation. The fibula is always missing when its bud is irradiated. The tibia, however, is rarely missing but is always reduced even if the fibula

exceeds it in length. There is competition between the two when they are equally irradiated, but this competition is not manifest when one is irradiated and the other is not. (T.R.H.)

8360

THE ORIGIN OF PRIMARY CYTOGENETIC RAY DAMAGES, AND THE CATALYTIC ACTIVITY OF CHROMOSOMES. N. V. Luchnik (Inst. of Biology, Urals Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 129, 1168-71(1959) Dec. 11. (In Russian)

The mitotic activity and chromosome mutations in anaphases and telophases of pea sprouts irradiated by 800 r of γ rays were studied in order to determine the nature of initial irradiation injuries. The analysis indicated two types of chromosome damage: true breakage and potential damage. The latter is expressed by a reverse depression of catalytic activity in the chromosome maternal region and is realized at a moment in the cytogenetic cycle which results in DNC (desoxyribonucleic acid) doubling. The results also show that chromosome autoreproduction finds its direct reflection in chromatid breakage, the quantitative study of which is simple and should in the future afford information on the details of autoreproduction. (R.V.J.)

8361

THE C-REACTIVE PROTEIN IN THE BLOOD OF MONKEYS TREATED WITH γ-RAYS. R. V. Petrov, A. S. Petrova, and V. V. Shikhodyrov. Doklady Akad. Nauk S.S.S.R. 129, 1190-2(1959) Dec. 11. (In Russian)

Observations of oncological patients during radiotherapy indicated the appearance of C-reactive protein during local or general irradiation. However, in such cases the appearance of C-reactive protein may be due to the pathological processes due to tumors. Studies of 10 monkeys Macaccus rhesus exposed to 600-r doses of γ rays 431 r/min showed that CRP appears in all cases following the exposure to lethal doses. The maximum quantities were found 2 days following the irradiation. Later the C-reactive protein may disappear. The C-reactive protein was always present in the dying animal. (R.V.J.)

8362

FREE NUCLEOTIDES AND NUCLEOSIDES IN RAT SPLEEN AFTER IRRADIATION. J. Soška and L. Soškova (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno and Univ. Faculty of Medicine, Brno). Folia Biol. (Prague) 5, 425-31(1959). (In English)

The level of nucleotides and nucleosides was studied in rat spleen before irradiation and 1, 2, 6, 18, 24, and 48 hours and four and thirteen days after. Photometric examination showed an increase in the nucleoside content from two to eighteen hours after irradiation. The content of desoxyribo-compounds was determined microbiologically. During the first 18 hours after irradiation the level of both types of these compounds was markedly raised, the maximum for desoxynucleotides (about 25-fold) occurring two hours after irradiation and for desoxynucleosides (7.5-fold) six hours after irradiation. Later (one, two, and four days after irradiation), at the time of inhibition of hematopoiesis, a marked decrease occurred in the level of free desoxyribonucleotides, while the level of desoxyribonucleosides remained practically normal. Chromatographic and microbiological detection showed desoxycytidine to be the predominant component among the desoxynucleosides. The authors are of the opinion that the decrease in the level of DNA-precursors in irradiated tissue is one of the causes of inhibition of DNA synthesis and of the decrease in hematopoietic activity. (auth)

8363

EFFECT OF IONIZING RADIATION ON DEOXYRIBONUCLEIC ACIDS. I. THE MOLAR RELATIONSHIPS OF DEOXYRIBONUCLEIC ACID BASES OF RAT HAEMATOPOIETIC TISSUE. E. Paleček (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 5, 432-9(1959). (In English)

The author confirmed the increase in the ratio of purine and pyrimidine bases in DNA from the spleen of rats total-body irradiated with a dose of 400 r and killed five days after irradiation. The DNA was isolated by a modification of the Schmidt-Thannhauser method. A relative decrease in pyrimidine bases was also found five days after irradiation with doses of 200, 100, and 50 r. Even after these small doses the change was statistically significant. After 400 r changes were also observed in rat bone marrow. The composition of splenic DNA was studied immediately after and three, six, and 24 hours after irradiation with a dose of 400 r. No change in the ratio of the bases was found immediately after irradiation. Three hours after, only the adenine/thymine quotient was raised. Six hours after, an increase in the adenine/thymine and guanine/cytosine quotient was observed. Twenty-four hours after irradiation changes in the A/T and G/C quotients approached the values found on the fifth day after irradiation. Since these changes occur so soon after irradiation, they are evidently not due to a disturbance of DNA synthesis. The author submits the hypothesis that they are due to enzymatic degradation of DNA. (auth)

8364

THE PATHOGENESIS OF LIVER DAMAGE AFTER WHOLE BODY X-IRRADIATION. M. Skalka (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 5, 446-52(1959). (In English)

The author studied the question of the pathogenesis of fatty degeneration of the liver during the second week after whole-body irradiation of mice and rats with lethal doses of x rays. It was found that direct irradiation of the liver and post-irradiation sepsis did not influence the development of liver injury. It was further demonstrated that post-irradiation fatty degeneration of the liver was not due to endocrine disturbances, but that glucocorticoids were necessary for its development as mediators. In the last section the author describes experiments in which marked correlation was found between the degree of anemia and the amount of liver fats in mice and rats during the second week after irradiation. (auth)

8365

BIOELECTRIC ACTIVITY CHANGES OF THE CEREBRAL CORTEX OF RABBITS DURING RADON INHALATION AND APPLICATION OF RADIOACTIVE BANDAGES. S. N. Ardashnikov and M. L. Rait. Med. Radiol. 5, No. 1, 18-22 (1960) Jan. (In Russian)

Changes of the bioelectric activity of the cerebral cortex of rabbits were studied directly during the process of irradiation by inhalation through a tracheotomic opening of air-radon mixture (radon concentration—13 to 17 mc/l) for 3 to 4 hours. Within the first 0.5 to 1 hour after the beginning of the irradiation, a drop in the intensity of oscillations by 1.5 to 2 times and more was noted for a majority of the animals. A decrease of cortical lability was observed, which can be assessed by the frequency changes and by the disappearance of alpha-like oscillations. In some rabbits the thresholds of excitation (sound) rise and the phase of depression became prolonged. The phase of exaltation was absent at the beginning of the irradiation. Upon the application of radioactive bandages, containing

0.4 to 2.0 μc of α-radiating isotopes of thorium C and C[1], no essential electroencephalographic changes were found. Only a somewhat larger variability of the cortical rhythm and reactivity was noted. (auth)

8366

LYMPH CIRCULATION CHANGES IN HIGH LOCAL DOSES OF IONIZING RADIATION. V. M. Mastryukova. Med. Radiol. 5, No. 1, 23-8(1960) Jan. (In Russian)

With the method of intravital lymphoroentgenography, changes in the lymph circulation of the rabbit's posterior extremity following local irradiation with high doses was investigated. It was revealed that local irradiation (4,500 r) provokes a disturbance of lymph circulation in the affected portion. On the 3rd day after the irradiation a sharp intensification of the "peristalsis" (pulsation) of lymphatic vessels and a compensatory inclusion of collateral channels into the lymph circulation was observed. On the 11th to 12th day a dilatation of lymphatic vessels occurred and lymph node capsule was formed 12th to 24th day which is characterized by a spread of the contrast substance into the surrounding tissues. The detection on roentgenograms of wide vessels with low contrastness and clear-cut contour, as well as of reserve vessels, characterizes anatomical and physiological changes of lymphatic vessels due to roentgen burn, which condition the difficulty of lymph flow and edema of tissues. This shows that the irradiation of the extremity with x-rays in a dose of 4,500 r leads to a disturbance of the lymph flow and deterioration of trophic processes in the affected portion of the body. (auth)

8367

THE PICTURE OF THE BLOOD AND BONE MARROW HEMATOPOIESIS OF GUINEA PIGS IN ACUTE RADIATION SICKNESS PROVOKED BY IRRADIATION WITH BETATRON 25 Mev. E. D. Goldberg. Med. Radiol. 5, No. 1, 28-35(1960) Jan. (In Russian)

The changes of the blood and bone marrow hematopoiesis in guinea pigs following total irradiation (500 to 7,000 r) was investigated. Early changes of blood leukocytes were revealed: the swelling of neutrophil nuclei, manifestations of rhexis, lysis of nuclei of neutrophils and lymphocytes, appearance in the first hours of hypersegmentary, and giant forms of neutrophils. The initial leukocytosis, beginning from the second day, changed to an absolute drop of the number of all elements of white blood cells. Immature myeloid elements and erythroblasts disappear in the bone marrow after the 2nd day. Reticular and plasmatic cells, and macrophags domppnate. The bone marrow puncture of one guinea pig (7,000 r) on the 5th day disclosed megalocytes and a few erythroblasts. In a number of guinea pigs, preparations of crystals of rombic form and of hemoglobin nature appeared. (auth)

8368

THE ROLE OF HYALURONIDASE IN THE MECHANISM OF AN EARLY INCREASE OF TISSUE BARRIER PERMEABILITY IN THE ACTION OF IONIZING RADIATION. N. I. Arlashchenko. Med. Radiol. 5, No. 1, 42-6(1960) Jan. (In Russian)

The action of ionizing radiation brought about a marked acceleration and increased the exit of the intravenously injected fluoresceine into the anterior eye chamber. It was found impossible to reproduce the reaction of hematoophthalmic barrier to ionizing radiation with the aid of intravenous and subjunctival injections of the apertase preparation ("Hoechst" hyaluronidase). It was concluded that the mechanism underlying the derangement of the tissue barrier permeability during the action of ionizing radiation differs from that occurring in the rise of the permeability of the connective tissue interstitial substance under the effect of hyaluronidase. At the same time stimulation of the sensitive elements of the eye nervous system by destruction of gasserian ganglion produced a marked acceleration and rise of the fluoresceine discharge into the aqueous humor of the anterior chamber. A suggestion was made that the primary deep disturbances of the vascular barrier occurring under the effect of ionizing radiation may be connected with the functionaly deranged nervous control of the barrier tissue functions. (auth)

8369

EAR TUMOURS IN RABBITS RECEIVING STRONTIUM-90. H. A. Sissons (Univ. of London) and Janet Vaughan (Churchill Hospital, Oxford). Nature 185, 399-401(1960) Feb. 6.

Rabbits which received single injections of 500 to 1,000 μc/kg of strontium-90 developed symptoms of lesions of the vestibular apparatus after six months. Histological examination showed the lesions to be squamous carcinomas of the external auditory meatus. Invasive squamous cell carcinomas of the external auditory meatus were found in both ears of some animals. (C.H.)

8370

ACCELERATORS IN BIOLOGY AND MEDICINE. Howard L. Andrews (National Cancer Inst., Bethesda, Md.). Nuclear Instr. and Methods 6, 96-100(1959) Dec. (In English)

The advantages and potentialities of an accelerator for the production of electrons and protons to be used in radiation effects studies in biology and medicine are discussed. (C.J.G.)

8371

EXPERIMENTAL STUDY OF INTERSTITIAL THERAPY WITH YTTRIUM-90 RODS. E. Frey (Universität, Zurich). Oncologia 13, 25-41(1960). (In German)

The radiation effect of interstitial, intratesticular implantation of yttrium[90] seeds of 2.5 mc., on the testicle of rats; 7, 14, and 36 days after implantation, is investigated. After 7 and 14 days, there appears, a round radionecrosis, about 8 mm in diameter; after 36 days, the radionecrosis appears oval, surrounding the long axis of the implanted seed, and measures effectively, considering the tissue shrinkage of the organ, about 7 × 8.5 mm. The maximal reach of the radiation effect is 10 to 11 mm. The radiation conditioned morphological and functional tissue changes are compared with the calculated radiation doses. Evaluating these results in implantion of one yttrium[90] seed of 2.5 mc centrally into the human pituitary, one can estimate a 70 to 80% destruction of the pituitary gland. (auth)

8372

X RAYS AND POLYPLOIDY IN MOSSES. J. Moutschen (Université, Liège). Radiobiol. Latina 2, 105-11(1959) Apr.-June. (In French)

In order to study the radiosensitivity of cells in different states of ploidy, protonemata and leafy stems were used from different plants of the moss Brachythecium rutabulum, hemiploid, haploid, diploid, and tetraploid. These tissues were irradiated with x rays (40 kv, 25 ma) at doses ranging from 0 to 1,000 kr (9,000 r per min), and the course of the cellular mortality was followed for several months. During the first month, the survival rate of the cells is in almost inverse order to their ploidy. Subsequently, the survival rates follow the same course in tissues of different ploidies. Nevertheless, after a dose of 200 kr, there is a small number of survivors which becomes more important as the ploidy rises. The leaves are more radiosensitive than the stems, and the stems are more sensitive than the protonemata, and this for all ploidies. Attention is drawn to the necessity in such a

study of considering the development of the whole pattern of the cellular lesions. (auth)

8373

ANATOMO-CLINICAL CONSIDERATIONS OF A CASE OF CLEAR-CELL CANCER OF THE KIDNEY TREATED BY TELECOBALT THERAPY. Ambrogio Helfer and Giuliano Morandi (Università, Milan). Radiobiol. Latina 2, 113-29 (1959) Apr.-June. (In Italian)

Morphological modifications induced by telecobalt therapy on a kidney which had been partially invaded by a clear-cell carcinoma are described. The effect of radiations has not reached a spacial homogeneity in the renal parenchyme and neither in the tumor itself. (auth)

8374

PERIPHERAL BLOOD PICTURE IN CANCER TREATED BY X-RAY OR TELECOBALT THERAPY. U. Nuvolone [Università, Rome]. Radiobiol. Latina 2, 139-67(1959) Apr.-June. (In Italian)

After a critical analysis of the literature on the effects of ionizing radiation on the peripheral blood, the author analyzes his own observations on 183 cancer patients treated with x rays or cobalt therapy, and concludes that the hematological changes are less after cobalt teletherapy than after x-ray therapy. These findings can be explained in terms of the biophysical characteristics of the two types of radiation. (auth)

8375

MORPHOLOGICAL AND HISTOCHEMICAL MODIFICATION OF EHRLICH ASCITES TUMORS FOLLOWING REPEATED IRRADIATION WITH X RAYS IN VIVO. B. Giovanella [Università, Rome]. Radiobiol. Latina 2, 169-78(1959) Apr.-June. (In Italian)

The authors irradiated mice carrying the Ehrlich ascites tumor with 750 r in fractionated doses and followed the changes in nucleic acids. Up to 750 r they observed a decrease of RNA and an increase of DNA, and 96 hours after the last irradiation an inversion of this relation, with a pronounced increase of RNA and a great diminution of DNA. Considerable alterations in the morphological distribution of the two acids were observed, and, after 300 r the pyronin-staining granules of the cytoplasm disappeared altogether. Further, they observed destruction of the reticular structure of the nucleus and fusion of the DNA into large masses which progressively joined up to form one single mass. (auth)

8376

ELECTROPHORETIC BEHAVIOR OF SEROPROTEINS AND LIPOPROTEINS IN TUMORS AFTER TELECOBALT THERAPY. G. Pisani and O. Andreoni [Università, Rome]. Radiobiol. Latina 2, 179-86(1959) Apr.-June. (In Italian)

The author studied the electrophoretic behavior of proteins and lipoproteins in cancer patients treated by cobalt teletherapy. Statistically significant changes were found only in the albumins and the globulins. The first decreased, while the second increased during and at the end of treatment. (auth)

8377

ANIMAL EXPERIMENTS ON THE COMBINED TREATMENT OF RADIATION INJURIES IN BLOOD-FORMING BONE MARROW WITH SPLEEN HOMOGENATE AND ATP. Hans-Jürgen Thom (Universität, Heidelberg, Ger.). Strahlentherapie 111, 26-39(1960) Jan. (In German)

Inbreed rats were irradiated with 800 rep 15 Mev electrons. Immediately following the irradiation a single i.v. injection of 0.5 ml spleen homogenate, obtained from 70×10^6 homologous spleen cells, was given. Also immediately following the irradiation and at the 3 following days 10 mg (= 0.5 ml) ATP were injected i.m. As in previous experiments with the only use of spleen cell suspension or spleen homogenate the combined treatment with spleen homogenate and ATP did not show an effect on the initial phase of damage in the blood forming bone marrow. However, the course of the qualitative and quantitative regeneration with a histologic restitution after 14 days as compared to 21 days of untreated control animals was more rapid. The better course of regeneration concerns principally the erythropoesis, but significantly also the myelopoesis. In contrast to the only treatment with spleen cell suspension or spleen homogenate the combined use of spleen homogenate and ATP has also an effect on the peripheral blood count: the neutrophile granulocytes and the hemoglobin have reached normal values in 3 weeks, the erythrocytes stay at the lower limit of normal. There is no effect on the peripheral lymphocyte count. (auth)

8378

BOUND IRON IN THE HEMOGLOBIN OF BIRD ERYTHROCYTES AFTER RADIATION IN VITRO. Hans Adam Künkel and Heinrich Maass (Universitäts-Frauenklinik, Hamburg). Strahlentherapie 111, 52-5(1960) Jan. (In German)

The synthesis of hemin is not inhibited by a radiation dose up to 25,000 r. However, an increased breakdown of the young blood cells, which are most sensitive to radiation, is caused by irradiation in vitro. By subsequent addition of glucose this radiation effect can be neutralized. (auth)

8379

NEWER STUDIES ON THE RECOVERY FROM RADIATION INJURY. Paul Lamarque (Centre regional contre le Cancer, Montpellier, France). Strahlentherapie 111, 75-84 (1960) Jan. (In German)

Results of studies on insect eggs and plant seeds exposed to single and fractionated doses of x and gamma radiation indicate that recovery from radiation is due to metabolism. Complete recovery did not occur. It was concluded that radiation injury consists of both a reversible and an irreversible part. (C.H.)

8380

STUDIES ON PASSIVE REACTION MECHANISMS OF RADIATION-PRODUCED RESISTANCE FACTORS OF THE LIVER AND SPLEEN WITH ALLYL-ALCOHOL DAMAGE. Wilhelm Eger, Wolfgang Hildebrandt, and Hanno Poppe (Universität, Göttingen, Ger.). Strahlentherapie 111, 99-106(1960) Jan. (In German)

Intraperitoneally given homogenate of liver from normal rats provides in other rats a protective action upon the liver, which has already been damaged by allyl alcohol. The homogenate of radiated animals shows a more marked action. The protective factor is found exclusively in the cytoplasm of the liver cell, whereas it is not found in the nuclei of cells and the mytochondria. In this fraction the protective factor of radiated animals is found to increase. The protective factor is thermolabil, it can be extracted by ether and proved in the residue of ether. The residual substance of the volatilized ether loses its action. The homogenate of the spleen of normal rats possesses no necrotropic characteristic toward liver, which has been damaged by ally alcohol. On the contrary the spleens of radiated animals have shown a necrotropic defensive action. The removal of the spleen reduces the ability of animals, after radiation, to increase their resistance to allyl alcohol. The blood-serum and blood clots contain no liver protecting factor. (auth)

8381
STERIOD EXCRETION IN THE URINE FROM RATS AND GUINEA PIGS UNDER INFLUENCE OF X-RAY IRRADIATION. Walter Teller, Wolfgang Staib, Helmut Haibach, and Matthias Hohn (Medizinische Akademie, Düsseldorf). Strahlentherapie 111, 107-13(1960) Jan. (In German)

A 60% increased excretion of 17-ketosteroids and a 90% decreased 17-ketogene steroid excretion was found following the irradiation of the adrenal region of healthy male rats with 1000 r. The irradiation of the head caused a protracted and prolonged increase of 17-ketosteroids of about 50%. A significant increase of the 17-ketosteroid excretion with normal distribution of the different fractions was found following irradiation of the adrenal region of healthy female guinea pigs with 150 r per day. The excretion of 17-ketogene steroids also increased significantly during x-ray irradiation. The literature about adrenal function during x-ray irradiation and tumor disease were compared with the results. (auth)

8382
STUDIES OF THE EARLY PHASE OF THE BIOLOGICAL CURVE OF THE LEUCOCYTES AFTER LOCAL IRRADIATION. THE STAGE OF REGULATION OF THE VEGETATIVE CHANGE. Wolfgang Dihlmann (Universitäts-Hautklinik der Charité, Berlin). Strahlentherapie 111, 114-21(1960) Jan. (In German)

Hemogram studies on x-irradiated patients demonstrate three phases in the response of leukocytes. These are described and discussed. (C.H.)

Radiation Sickness

8383
LOCAL CHEMICAL PROTECTION OF THE SKIN AGAINST ROENTGEN RADIATION INJURY. B. Fogh (Univ. of Copenhagen). Acta Radiol. 53, 49-56(1960) Jan.

The effect of cooling and the application of certain chemical compounds in increasing the skin tolerance, based upon an investigation in rabbits are discussed. Cysteamine and p-methoxy-thiophenol more than doubled the tolerance; the reaction became milder and developed faster, and the hairs reappeared after up to 13,500 r. Cysteamine seemed also to afford protection when applied after irradiation. (auth)

8384
THE SIGNIFICANCE OF THE BLOOD PICTURE IN THE PROGNOSIS OF RADIATION SICKNESS IN MICE. Z. Karpfel and J. Soška (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 5, 440-5 (1959). (In English)

The course of changes in the number of leukocytes and erythrocytes was studied in 1,140 mice irradiated with a dose of 500 r. The results show that the degree of anemia is of great significance for the prognosis of radiation sickness. Animals with a lower pre-irradiation leukocyte level were more resistant to the effects of the given radiation dose, as manifested in a higher survival rate and a smaller decrease in the number of erythrocytes after irradiation. (auth)

8385
TISSUE ANOXIA IN THE TERMINAL STAGE OF RADIATION SICKNESS. M. Skalka (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 5, 453-7(1959). (In English)

It was found that increased post-mortem accumulation of lactic acid occurs in the brain tissue of mice with anoxemic hypoxia, as in rats, rabbits, and dogs. Other measures resulting in cerebral hypoxia (hemorrhagic shock, methemoglobinemia induced by sodium nitrite) also produced the same reaction. The accumulation of lactic acid in the brain of mice irradiated with a dose of 600 r was not higher on the eighth day after irradiation than in unirradiated mice. These mice reacted like normal mice by increased accumulation of lactic acid in the brain in the presence of anoxemic hypoxia. The increase in the accumulation of lactic acid during the second week in the brain of mice irradiated with a dose of 630 r was proportional to the decrease in the erythrocyte count. This finding is regarded as evidence of hypoxia in severe post-irradiation anemia and the role of anemia and associated hypoxia in post-irradiation death is discussed. (auth)

8386
PATHOMORPHOLOGICAL CHANGES OF THE GASTROINTESTINAL TRACT IN CHRONIC RADIATION SICKNESS. V. B. Zairatyants. Med. Radiol. 5, No. 1, 35-42(1960) Jan. (In Russian)

In chronic radiation sickness morphological changes develop in the gastrointestinal tract. Early changes are found in the nervous apparatus of the stomach and intestine and are manifested by phenomena of irritation of the nervous apparatus. With the progressing of the disease there appear phenomena of reorganization in the gastric mucous membrane, terminating by processes of atrophy and sclerosis. In the intestine processes of destruction are observed, which develop later than in the stomach. (auth)

CHEMISTRY

General and Miscellaneous

8387 AECU-4560
Massachusetts Inst. of Tech., Cambridge and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
ANODIC PRECIPITATION OF TRACER MANGANESE AS DIOXIDE. Edward A. Heintz and L. B. Rogers. [1959?]. 25p. Contract AT(30-1)-905. OTS.

Quantitative recovery of carrier-free 10^{-9} M manganese(II) is possible from weakly acidic solutions. The use of lead dioxide as a non-isotopic or a chemical displacing agent allows for high recoveries from more acidic solutions. (J.R.D.)

8388 AECU-4614
Washington Univ., St. Louis.
FINAL REPORT, JANUARY 20, 1948–SEPTEMBER 14, 1959. David Lipkin. 17p. Contracts AT-29-1-GEN-77 and AT(11-1)-268. OTS.

A large number of organic compounds was prepared. Emphasis was placed on investigations on macromolecular nucleic acids, relatively low molecular weight nucleic acid, related compounds, and organic phosphorus compounds. Data are included from investigations of base-catalyzed alcoholysis of ribonucleic acids, the action of aqueous and anhydrous hydrogen fluoride on nucleic acids, the oxidation of nucleic acids by means of the chromium trioxide-pyridine complex, relatively low molecular weight nucleic acid-related compounds and organic phosphorus compounds in general, the preparation of deoxy sugars, the chemistry of deoxyribose, the halogenation of nucleosides and nucleotides, the degradation of adenosine-5-triphosphoric acid in alkaline media, neutral esters of polyphosphoric acids, the alcoholysis of inorganic cyclic metaphosphates, the reductive dearylation of phosphorus esters, and miscellaneous experiments. (C.H.)

8389 AFOSR-TN-58-559
Illinois. Univ., Urbana.
OBSERVATIONS ON THE RARE EARTHS: CHEMICAL AND ELECTROCHEMICAL STUDIES IN NON-AQUEOUS SOLVENTS. Therald Moeller and Dorian Sevcik Smith. July 2, 1958. 120p. Project No. 40-30 (7772). Contract AF18 (600)-1535. (AD-158377).

The apparatus and techniques used in the electrodeposition of active rare earth metals from non-aqueous solvents are discussed. Data on the solubilities in corresponding alcohols, x-ray-diffraction patterns, d-spacings, and absorption spectra of several neodymium chloride alcoholates prepared in ethanol, methanol, n-propanol, and n-butanol are presented. Conductivity studies on neodymium chloride in the alcohols indicated the salt to be a weak electrolyte. Dimethylformamide (DMF) proved to be unsatisfactory as a solvent from which to deposit rare earth metals. Compounds containing DMF of solvation ($ThCl_4 \cdot 4DMF$, $NdBr_3 \cdot 8DMF$, and $SrCl_2 \cdot 3DMF$) were prepared. Spectra of samarium(III) and europium(III) chlorides in DMF indicated pronounced association of DMF with the rare earth ions. (C.J.G.)

8390 AFOSR-TR-59-75
Illinois. Univ., Urbana.
ELECTRODEPOSITION OF RARE-EARTH METALS FROM AQUEOUS AND NON-AQUEOUS SOLUTIONS. Therald Moeller, Paul A. Zimmerman, Victor D. Aftandilian, Glenn W. Cullen, Valentine D. Galasyn, Dorian S. Smith, and Gynith C. Giffin. July 31, 1959. 25p. Contract AF18(600)-1535. (AD-220100).

Electrodeposition of the rare-earth metals in aqueous systems was studied. Many non-aqueous protonic solvents were found to dissolve the anhydrous rare-earth metal salts, but the resulting solutions exhibited weak-electrolyte behaviors. Electrolysis did not yield more than small quantities of the metals unless mercury was the cathode. (auth)

8391 ANL-6068
Argonne National Lab., Lemont, Ill.
CHEMICAL ENGINEERING DIVISION SUMMARY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1959. 165p. Contract W-31-109-eng-38. OTS.

Chemical-Metallurgical Processing. A direct-cycle pyrometallurgical plant is being designed in conjunction with the Experimental Breeder Reactor No. II. Chemical-metallurgical methods, including melt refining, liquid metal extraction, and processes involving fractional crystallization from liquid metals, are being examined for use in this fuel-processing facility. In continuing tests of radiation stability, white fluorescent-type mercury vapor lamps proposed for cell lighting are demonstrating very favorable resistance to gamma darkening. A study of the melt refining of 20% Pu–U–fissium alloys continued. A further study is reported of the reaction in a melt-refining furnace between ZrO_2 and graphite to produce CO_2. The presence of an oxide film on the surface of spent fuel pins may cause complications in melt refining, by causing incomplete U coalescence. Experiments on the nitriding rates of melt-refining slags imply that significant nitride formation will occur if they are stored in a cell atmosphere containing a few % N_2. The slag can be removed from the ZrO_2 crucible relatively easily by oxidizing it to U_3O_8 and the corresponding fission product oxides. Uranium is recovered from the oxide powder by contacting it with a Zn or Cd solution containing about 2 wt.% Mg. Work was continued on development of processes for isolation of Pu from EBR-II blanket material. Runs simulating recovery of Pu from Mg-rich Cd solutions by distillation of the Cd and Mg were very successful. In one dragout process scheme now being considered, U metal is precipitated by concentrating the metal solution in Mg. A mild steel loop in which was circulated a Cd-2% U-0.2% Mg alloy at 500°C for 1000 hr has shown no significant signs of corrosion. Thousand-hour dynamic capsule corrosion tests of 2 to 10% Zn–Cd solutions at 975°C showed readily detectable corrosion only by the 10% Zn system. The following solubilities were measured; Ba in Cd, Sr in Cd, and Pd in Zn. The solubility of U in Cd was determined. Additional data on the solubility of U in Cd–Zn and Cd–Mg liquid alloys were obtained. Combustions of Mo in oxygen were carried out. Fuel Cycle Applications of Volatility and Fluidization Techniques. The volatility of UF_6 is used as a basis for several schemes for processing irradiated fuels. A process is being developed for the direct fluorination of ceramic fuel containing uranium oxide. Additional values after equilibrium constant were obtained for the reaction $PuF_4 + F_2 \rightleftharpoons PuF_6$ at 200, 250, and 350°C. Development of a fluid-bed volatility process for the recovery of U from low-U–Zircaloy-2 fuel alloys continued. A study was made in a $1\frac{1}{2}$-inch diameter fluid-bed reactor of the reaction between ZrF_4 and air–steam–hydrogen fluoride mixtures. Static corrosion experiments conducted in F_2 at 675°C in the presence of nonfluidized ZrF_4 indicate Monel is severely attacked dimensionally, while "A" nickel shows reasonable corrosion resistance. Further laboratory-scale studies on the fluorination of fluid-bed dried solids of high Zr concentration indicate that temperatures in excess of 600°C are needed for complete U removal in less than 30 minutes from the experimental samples. In studies of the Fused Fluoride Volatility Process three Zr dummy fuel elements were dissolved in the graphite, pilot-plant dissolver. A preliminary test of the electrolytically heat frozen-wall fluorinator was carried out. A series of runs was made on the fluid-bed calcination of synthetic Purex process waste. Reactor Safety. In the continuing study of ignition and burning of U and Zr, more emphasis is being placed on the burning process. Preliminary burning-propagation experiments were completed on a Pu alloy foil in air and in oxygen. The experimental program to determine rates of reaction of molten reactor fuel and cladding metals with water is continuing. Reactor Chemistry. The reactor decontamination program is discussed. (For preceding period see ANL-5959.) (W.L.H.)

8392 BM-RI-5567
Bureau of Mines.
ELECTRONEGATIVITIES OF THE RARE-EARTH ELEMENTS. R. L. Montgomery. 1960. 14p.

Electronegativities of rare earths were calculated from heats of formation. Revised values are given for the more electropositive elements including the metals. Results are compared with other estimates. (J.R.D.)

8393 CEA-1066
France. Commissariat à l'Énergie Atomique, Paris.
CONTRIBUTION A L'ÉTUDE DE L'ÉCHANGE CATALYTIQUE HYDROGÈNE–DEUTÉRIUM ENTRE L'HYDROGÈNE ET LES HYDROCARBURES. (Contribution to the Study of Catalytic Hydrogen–Deuterium Exchange Between Hydrogen and Hydrocarbons). Jean Ravoire. Dec. 20, 1958. 53p.

Thesis submitted to the Univ. of Lyon.

The hydrogen-deuterium exchange between molecular hydrogen and hydrocarbons over a platinum and charcoal catalyst was studied in a static system. The change in isotopic composition of molecular hydrogen was followed by a thermal conductivity method. Cyclopentane and cyclohexane were chosen because of their stability. A reversible

inactivation of the catalyst was observed with both hydrocarbons. The reasons for this inactivation are unknown but it was shown that reactivation led to satisfactory reproducibility. A kinetic study was done with cyclohexane in the range 30 to 160°C, and 40 to 360 mm for the pressure of hydrogen, and 10 to 70 mm for the pressure of cyclohexane. The order of the reaction with respect to cyclohexane pressure is always close to zero; the order with respect to that of hydrogen is 0.5 above 100°C. It decreases with increasing temperature and becomes negative (−0.5 at 30°C), characterizing an inhibition by hydrogen. At the same time, the apparent activation energy goes from 6 to 13 kcal/mole. (auth)

8394 CF-59-12-10
Oak Ridge National Lab., Tenn.
RESULTS OF DIFFERENTIAL BED STUDY OF THE KINETICS OF THE ABSORPTION OF UF_6 ON SODIUM FLUORIDE. F. R. Groves, Jr. Jan. 15, 1960. 35p. OTS.

A procedure for studying absorption kinetics involving temperature measurements in an adiabatic differential reactor was developed. The method was tested for the absorption of HF from a nitrogen stream on NaF pellets. The method was applied to a study of the kinetics of the absorption of UF_6 from nitrogen onto NaF. (auth)

8395 CT-2276
Chicago. Univ. Metallurgical Lab.
BOMB REDUCTION OF URANIUM AND URANIUM ALLOYS. Final Report on Problem No. 215-ML-54-7A, File Series 50. G. Derge and A. E. Martin. Oct. 26, 1944. Decl. Jan. 28, 1960. 60p. OTS.

Small-scale reductions of uranium halides and rare earth halides were carried out with the view of developing techniques which could later be applied to the reduction of product halides. The project was discontinued before the latter reductions were attempted. A secondary object was to investigate the possibility of producing high purity uranium by bomb reductions. Successful reductions of UF_4, UCl_3, UCl_4, and UCl_5 by Ca, Ba, Sr, Li, and Mg and of $CeCl_3$, $CeBr_3$, and $LaBr_3$ by Ca and Ba were accomplished. The temperature of reaction between $CeCl_3$ and Ca was determined as 575°C. Comparisons were obtained among the reducing agents, the halides and the crucibles used in the reductions based upon yields of uranium and its purity. Calcium and magnesium were found to be the best all-around reducing agents. UF_4 and UCl_3 were the most satisfactory uranium halides. Uranium produced in MgO crucibles was higher in boron and silicon than metal produced in beryllia crucibles, but on the other hand there was less contamination with Mg from MgO crucibles than with Be from BeO crucibles. The value of a controlled atmosphere furnace for bomb reductions was established as well as the use of vibration during small-scale reductions. A eutectic structure in uranium samples obtained by reductions of uranium halides in beryllia crucibles was correlated with the beryllium content. The value of an addition of $CaCl_2$ to the charge in UF_4 reductions to lower the melting point of the slag and thus promote a better separation of slag and metal was demonstrated. (auth)

8396 DMIC-Memo-41
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
THE PROPERTIES OF BORON. D. N. Williams. Jan. 4, 1960. 8p. (PB-161191). OTS.

A survey of the properties of boron is presented. The properties include density, melting point, hardness, elastic modulus, and specific heat. (W.L.H.)

8397 IS-8
Ames Lab., Ames, Iowa.
PREPARATION OF YTTRIUM FLUORIDE USING FLUORINE. R. L. Tischer and G. Burnet. June 1959. 40p. Contract W-7405-eng-82. OTS.

An investigation of the production of YF_3 using elemental fluorine as the fluorinating agent is discussed. Preparation of YF_3 by direct fluorination of Y_2O_3 was found to be a spontaneous exothermic process which ceases short of equilibrium under the conditions studied. Results of thermochemical calculations are included as well as results of fluorination tests. (J.R.D.)

8398 JLI-650-3-7
Johnston (William H.) Labs., Inc., Lafayette, Ind.
ION-MOLECULE REACTIONS. H. M. Rosenstock, C. R. Mueller, M. B. Wallenstein, Marvin L. Vestal, Audrey Tory, Diana Rivers, and W. H. Johnston. Oct. 1959. 99p. Contract AT(11-1)-650. OTS.

Experimental techniques for studying ion–molecule reactions are discussed. A survey of all reactions previously reported is presented, and some qualitative observations concerning these processes are made. The theory of microscopic and macroscopic cross section calculations is considered. Elastic scattering, the potential function, ion clustering, and the decomposition of a polyatomic ion–molecule complex along competing reaction paths are theoretically treated. The role of ion–molecule reactions in irradiated gaseous systems is discussed relative to hydrogen reactions, the radiolysis of acetylene, methane, and ethylene, the polymerization of terminal olefins and isobutene, and the oxidation of nitrogen. Application of the theory of ion–molecule reactions to advances in radiation chemistry and in high-level radiation technology is discussed. (C.J.G.)

8399 MSAR-60-16
MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 56 FOR DECEMBER 1959 AND JANUARY 1960. W. J. Posey, ed. Feb. 16, 1960. 48p. Contract NObs-77023.

Engineering: The experiment on film boiling with water inside tubes was terminated. An investigation of the caustic stress corrosion of austenitic stainless steel at high heat flux was begun. A project is reported to investigate the ability of 1-inch Sch 40 Inconel piping to withstand stress corrosion at conditions found to be harmful to austenitic stainless steel. Chemistry. The reaction rates of sodium sulfite and dissolved oxygen in boiler water and feed water were studied as a function of temperature, oxygen concentration, phosphate concentration, pH, and copper concentration. A study of decontamination of radioactive components is being made to provide information for a decontamination handbook. (For preceding period see MSAR-59-136.) (W.L.H.)

8400 NP-8351
Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.
DISSOLUTION KINETICS AT DISLOCATION ETCH PITS IN SINGLE CRYSTALS OF LITHIUM FLUORIDE. Technical Report No. 4. M. B. Ives and J. P. Hirth. Dec. 1, 1959. 35p. Project No. Nr-036-046. Contract Nonr-760(17).

The dissolution kinetics, at dislocation sites, of lithium fluoride in water was studied as a function of time, temperature, unsaturation, and inhibitor concentration. The ledge theories are reviewed, and the experimental results on etch pit formation in lithium fluoride crystals are compared with the predictions of the theories. The etch pits were produced at dislocation-surface intersections on the {100} faces of lithium fluoride with an etchant consisting of

a dilute solution of ferric fluoride in distilled water. Good agreement was obtained between experimental results and theoretical predictions with the exception of the dependence of pit slope on undersaturation. The concept of a time-dependence in the kinetics of dissolving crystal ledges is used to reconcile the above exception with the theoretical predictions and to explain the inapplicability of the topographical theory in the case of dislocation etch pits. Results indicate that the onset of multilayer adsorption at the ledges of lithium fluoride occur for ferric ion concentrations of 5 to 10 ppm. The pit width rate variation as a function of lithium fluoride concentration is discussed. (C.J.G.)

8401 NP-8356

New Mexico Highlands Univ., Las Vegas.

THE BEHAVIOR OF SOME NIOBIUM(V)–HALIDE COMPLEXES IN AQUEOUS MEDIA. James H. Kanzelmeyer, B. M. Procter, and Patricia Mack. May 27, 1959. 53p. Contract Nonr-1839(00).

The absorption curves of niobium in ether–HCl solutions containing concentrations of water of 0.00062 to 0.0740 M are given. Absorption peaks were noted at 260, 281, and in the region 310 to 330 m μ. The species absorbing at these wavelengths are referred to as Species I, II, and III. Species II was determined to be anionic and probably of the form $Nb(OH)_2Cl_4$. Species I is cationic and Species I, III, or both are binuclear. The coordination number of niobium is most likely 6. Evidence is presented that potassium fluoniobate, when dissolved in water, acts as a moderately strong acid reacting with four hydroxides per niobium to form a soluble niobate. The reaction appears to be both reversible and rapid. A structure is proposed for the compound, taking into account these observations and the measured conductance of the solutions. The ionic structure consists of two niobium(V) atoms held together by an ozo linkage, each niobium being covalently linked to five fluorides and one hydroxyl. Extraction ratios of niobium(V) between aqueous chloride and organic solvent phases were studied using a Nb^{95} tracer. Reactions of $NbCl_5$ with pyridine and tetramethylammonium chloride in organic media were studied and analyses were performed on all resulting precipitates for Nb, Cl, C, H, N, and Li. (C.J.G.)

8402 NP-8362

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

PHOTON SPIN-LATTICE RELAXATION TIMES IN VERY DILUTE AQUEOUS SOLUTIONS OF Ni^{++} AND Mn^{++} IONS. Report No. 124/OFJ. J. W. Hennel, K. Krynicki, T. Waluga, and G. Zapalski. Dec. 1959. 10p.

Proton magnetic spin-lattice relaxation time (T_1) was measured in air-free aqueous solutions in the Ni^{2+} concentration range between 2×10^{16} and 2×10^{18} ions/cm^3. For Ni^{2+} and Mn^{2+} ions, the dependence of $1/T_1$ on the concentration throughout the temperature range of 10 to 90°C was shown to be linear. A simple method was developed for obtaining air-free samples of aqueous solutions. (auth)

8403 NYO-2569

Aeroprojects, Inc., West Chester, Penna.

APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 15 Covering Period April 1, 1959 to May 31, 1959. June 1959. 28p. Contract AT(30-1)-1836. OTS.

Further testing of ultrasonic multistage equipment for the agglomeration of dilute radioactive particulates has established a configuration generally suitable for field test work. Experimentation over a limited range of flow rates indicates removal of sodium chloride test aerosols to a level approaching the limit of flame photometric analysis. The ultrasonically activated tantalum crucible obtained for pyrometallurgical extraction has proven to be satisfactory when evaluated by a room-temperature simulant system—ultrasonic extraction of copper from a copper–mercury alloy with dilute nitric acid. Experiments in the ultrasonic disintegration of fuel element cladding in mercury have shown that a direct-coupling technique is superior in effectiveness to close proximity treatment. The elevation of the treatment temperature to the boiling point of mercury has increased the erosion rate of Zircaloy-2 (2.5 mg/cm^2/hr) by approximately 10-fold over that at temperatures up to 200°C. Work with two other types of ultrasonically activated ion-exchange columns indicates increased ultrasonic activity in the resin bed. This permits operation nearer equilibrium conditions and at higher flow rates than with non-ultrasonically activated columns. Both the breakthrough capacity and the apparent total capacity of the resin have been increased. Preliminary work has been initiated on the application of ultrasonic vibration to ceramic processing. (For preceding period see NYO-2568.) (auth)

8404 NYO-2594

Consolidation Coal Co. Research and Development Div., Library, Penna.

UTILIZATION OF RADIOACTIVE ISOTOPES IN COAL PROCESS RESEARCH. Quarterly Technical Status Report No. 2 [for] June 1, 1959–August 31, 1959. P. M. Yavorsky and E. Gorin. Sept. 15, 1959. 34p. Contract AT(30-1)-2350. OTS.

Naphthalene, decalin, and tetralin were labeled with tritium. The distribution of the tritium between the parent compound and the products of radiation damage were determined. The tritiated parent compounds were separated and recovered in pure form. Gamma absorption measurements based on the 0.662 Mev gamma ray of Cs^{137} were used successfully to locate the fluidized bed interface in the coal-water system. Tracer measurements were successfully applied to tracing the movement of fine coal injected into a fluidized bed of coarse coal. (For preceeding period see AECU-4500.) (auth)

8405 ORNL-2816

Oak Ridge National Lab., Tenn.

REDUCTION OF CUPRIC OXIDE BY HYDROGEN. II. CONVERSION OF HYDROGEN TO WATER OVER FIXED BEDS. W. D. Bond and W. E. Clark. Feb. 12, 1960. 15p. Contract W-7405-eng-26. OTS.

The conditions under which hydrogen could be quantitatively recovered from mixtures of gases by oxidation over fixed beds of CuO were investigated. The conversion of H_2 to H_2O by reduction of CuO in fixed beds increased with increasing bed length, temperature, hydrogen/argon ratio, and decreasing mesh size of CuO. Residence times required for 99% conversion in a 1-in.-diam. bed were 0.6 and 1.2 sec for 30% hydrogen-70% argon and 10% hydrogen-90% argon mixtures, respectively, at a total gas flow of 1 l/min. The CuO used was 25-mil-diam. wires with a surface area of 0.019 m^2/g. The residence time required for a given value of conversion decreased about 10% when the total flow rate was increased from 1 to 1.7 liters/min, which indicates that the reduction is mass-transfer controlled to a slight extent under the experimental conditions used. (auth)

8406 ORNL-2864

Oak Ridge National Lab., Tenn.

ORGANIC COMPOUNDS IN FISSION REACTORS. II. THORIO-ORGANIC COMPOUNDS. W. H. Baldwin. Feb. 29, 1960. 5p. Contract W-7405-eng-26. OTS.

The advantages of the use of organic liquids in fission reactors to minimize corrosion and pressure problems were studied relative to the solution of thorium in such fluids. Thorio-organic compounds were prepared from organic acids, diketones, and other chelating compounds. Salts of carboxylic and phospho-organic acids were insoluble. The chelate with dibenzoylmethane was soluble in molten biphenyl but was decomposed at 300°C. The general low solubility of thorio-organic compounds in nonpolar solvents can be explained by steric effects. The large thorium atom has the ability to form strong coordination complexes with adjacent molecules, leading to coordination polymers. This effect can be minimized by shielding the thorium nucleus with large organic groups such as dibenzoylmethane. The large, branched organic groups needed to impart solubility limit the maximum solubility. (auth)

8407 ORNL-2889
Oak Ridge National Lab., Tenn.
NONNUCLEAR USES FOR DEPLETED URANIUM. J. C. Bresee, E. D. Arnold, S. D. Clinton, B. R. Fish, P. A. Haas, J. R. Muir, C. R. Patterson, S. Peterson, C. D. Scott, and C. M. West. Mar. 2, 1960. 75p. Contract W-7405-eng-26. OTS.

A survey on nonnuclear uses for depleted uranium is presented. A description of uranium health protection practices and a listing of potential commercial chemical and metallurgical uses for uranium are given. The nuclear market for depleted uranium was reviewed to establish the availability of depleted uranium for nonnuclear purposes. (auth)

8408 PRL-5.27
Pennsylvania State Univ., University Park. Petroleum Refining Lab.
FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report for April, May, and June 1959. Harold Adams. June 30, 1959. 96p. Contract AF33(616)-5460.

Studies were directed toward extending the temperature range of mineral oils by super-refining and low-temperature dewaxing and evaluating the thermal degradation products of mineral oils and hydrocarbons. Data are shown for various properties of the charging stock, the oil fraction, and the wax fraction for dewaxings involving paraffinic and naphthenic mineral oils and aromatic and polyolefin hydrocarbons. Sufficiently severe dewaxings (−65 to −80°F) produced an oil phase exhibiting extrapolated viscosity values at the pour point in the range of 200,000 to 500,000 centistokes. A two-stage dewaxing procedure indicates that a wax-oil separation approaching the theoretical yield of each component can be obtained using simple dewaxing techniques. Changes in viscosity level and viscosity-temperature characteristics for both the oil fraction and the wax fraction are noted. In many cases the viscosity-temperature characteristics of the oil and wax fractions are both better than those of the original oil prior to separation. The effect of pour depressants on filtration time and on the amount of oil occluded with the wax cake was determined. Studies to determine the most efficient solvent for use in low-temperature dewaxings are outlined. These studies include the evaluation of various solvent to oil ratios employing a single solvent as well as advantages and disadvantages encountered using a mixture of solvents. The effect of cooling rate and dewaxing temperature was evaluated by using dry ice (−110°F) as a coolant as well as the conventional cold box (−65 to −80°F). A series of thermal stability tests were conducted to determine the basic trends in thermal behavior of fluids in a semi-quantitative manner. The fluids used in these studies include paraffinic and naphthenic mineral oils and aromatic and polyolefin hydrocarbons. A modification of the liquid seal for the glass thermal stability apparatus is described. The modified seal allows gas leakage from the test unit at a pressure drop greater than 0.3 inch of mercury but prevents the leakage of air into the unit at a pressure drop of less than 24 inches of mercury. The thermal degradation reactions occurring were studied by determining the rate of gas formation; by the analysis of the gaseous product which is non-condensable at room temperature; and by a more rigorous examination of the liquid product. These studies were carried out with the products from thermal stability tests conducted in a stainless steel pressure cylinder. The rate of gas formation was measured as a function of pressure build-up with test time. The effect of variables such as heated gas space and test temperature on reaction rate was investigated. The gas phase of the thermal degradation products was analyzed quantitatively using a Perkin-Elmer Single-Stage Vapor Fractometer. A small scale vacuum fractionation was used to evaluate further the liquid product from the thermal stability tests. Boiling point ranges of the liquid products are compared to that of the original test fluid. The data show that the degradation product contains a fraction boiling below the charging stock, a fraction boiling in the same range as the charging stock, and a fraction boiling higher than the original test fluid. Data are presented which suggest the establishment of an equilibrium between degradation products and reactants in the thermal behavior of the mineral oils tested. (For preceding period see PRL-5.25.) (auth)

8409 UCRL-8909
California. Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR-MAGNETIC-RESONANCE STUDIES OF HYDROGEN BONDING (thesis). Jefferson Clark Davis, Jr. Oct. 26, 1959. 76p. Contract W-7405-eng-48. OTS.

The nuclear-magnetic-resonance spectra of hydrogen bonding systems in noninteracting solvents were studied at several concentrations at 20 to 100°C. Chemical shifts were measured at 60 Mc for the carboxyl protons of formic, acetic, and benzoic acids in benzene. The shifts characteristic of the monomer and dimer species were calculated. Shieldings of the monomer species were calculated to be of the same order as those of alcohol monomers. The dimer shieldings were found to be in the range of 300 to 400 cps below the benzene reference. The dimer shieldings increase with the strength of the hydrogen bond. Chemical shifts were also measured for methanol, ethanol, isopropanol, and tertiary butanol in carbon tetrachloride and for ethanol in benzene. The enthalpies of dimerization were estimated from the change in the limiting slopes of shift vs. concentration curves with temperature and found to be -9.3 ± 2.5, -7.4 ± 2.0, -6.5 ± 1.5, -5.4 ± 1.8, and -5.6 ± 1.6 kcal per mole of dimer, respectively. At 22°C, the dimerization constant for ethanol in carbon tetrachloride is 11.0 for a cyclic dimer and twice this for a linear dimer. Probable higher polymers were estimated for the ethanol system, and the experimental data were fitted by adjusting polymer shieldings and equilibrium constants. (auth)

8410 WADC-TR-57-143(Pt. IV)
Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF THERMALLY STABLE SILICON CONTAINING RESINS. Period covered: November 16, 1958 to November 15, 1959. L. W. Breed and William J. Haggerty, Jr. Nov. 1959. 84p. Project Nos. 7340 and 7371. Contract AF33(616)3675.

Continuing research on the preparation of silicon-

containing polymers that are thermally stable and more rigid at elevated temperatures includes the preparation of both siloxane and nonsiloxane polymers as well as various intermediates and prototype compounds. Attempts to prepare certain bulky monomers, particularly silanes based on s-triazine, were unsuccessful, but siloxanes with bulky pendant groups were prepared. Siloxane polymerization reactions, hydrolysis and ester elimination, were also examined. Non-siloxanes that were studied include the systems silicon–oxygen–aluminum, silicon–oxygen–titanium, silane–pentaerythritol, and silane–piperazine. Whenever possible, monomers were selected to yield preordered polymers. None of the new systems have properties that equal those of the previously prepared siloxanes. (auth)

8411 Y-1285

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. REDUCTION CELL WITH VERTICAL ROTATING MERCURY CATHODE. F. A. Schimmel. Jan. 22, 1960. 21p. Contract W-7405-eng-26. OTS.

An electrolytic cell was developed for the reduction of uranyl sulfate in a single-stage continuous operation. (auth)

8412 CC-3356

INVESTIGATIONS OF THE CHEMISTRY OF POLONIUM. PART I. COMPOUNDS OF DIVALENT POLONIUM. A. G. Samartseva. Translated by E. Rabinowitch from Trudy Gosudarst. Radiev. Inst. 4, 253-303(1938). 72p. (AEC-tr-730). JCL or LC.

The chemical, collodial, and electrochemical properties of Po were studied. The theory and methods of electrochemical deposition of Po on silver are discussed. The adsorption of Po on glass in acid and alkaline media was studied. The separation of Te and Po by hydrazine hydride is discussed. The migration of Po ions in an electrical field is considered. (C.J.G.)

8413 CEA-tr-X-184

MÉTHODE D'OBTENTION D'UN DÉPOT ÉLECTROLYTIQUE DE THORIUM. (Method for the Obtention of an Electrolytic Deposit of Thorium). Translated by S. S. Minn from Japanese Patent No. 172, 315. Inventors: Koizumi, Hiragawa, Adachi, and Kobayashi. Date of Patent Feb. 12, 1946. 5p.

A method for depositing Th on electron emitter plates is described. It consists of electrolysis of an oxalic acid–$Th(OH)_4$ solution at 15 a/dm^2. (T.R.H.)

8414 NP-tr-336

GROWTH OF CRYSTALS. (Rost Kristallov). Translation of Selected Articles from "Doklady Na Pervom Soveshchanii po Rostu Kristallov, 5-10 Marta 1956 G." Publishing House of the Academy of Sciences, Moscow, 1957. 283p. OTS.

Twenty-one papers are presented on the growth of crystals. They cover the general topics of methods of growing crystals, apparatus, and properties of crystals. (W.L.H.)

8415

SEPARATION OF CADMIUM FROM URANIUM, COBALT, NICKEL, MANGANESE, ZINC, COPPER, TITANIUM, AND OTHER ELEMENTS BY CATION EXCHANGE CHROMATOGRAPHY. F. W. E. Strelow (South African Council for Scientific and Industrial Research, Pretoria). Anal. Chem. 32, 363-5(1960) Mar.

A study of the distribution curves of cations with AG 50W-X8 resin in hydrochloric acid showed that most cations are adsorbed strongly from 0.5 N hydrochloric acid, while cadmium is not. This fact was used to develop a cation exchange chromatographic procedure to separate cadmium from uranium, cobalt, nickel, manganese, zinc, copper, and titanium. Other cations that are completely separated include Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Fe^{2+}, Fe^{3+}, Al^{3+}, ZrO^{2+}, Th^{4+}, Y^{3+}, La^{3+}, and the rare earths, and Cs^+. Stannic tin accompanies cadium quantitatively and can be separated from the cations named above by a similar procedure. (auth)

8416

RESEARCH ON THE SYSTEM UO_2–ThO_2–ZrO_2. Cesare Brisi. Atti accad. sci. Torino. Classe sci. fis. mat. e nat. 94, 67-76(1959-60) (Pub. 1960). (In Spanish)

The solids obtained by heating a mixture of UO_2, ZrO_2, and ThO_2 to 1400°C in a current of H_2 were studied. In the ZrO_2-poor region a cubic phase is formed in these conditions in which the ZrO_2 concentration goes gradually from a maximum of 17 mole % to less than 1 mole % with an increase in the amount of Th present. The ZrO_2 can dissolve about 8 mole % of UO_2. The solubility limit found for 1000°C practically coincided with that of the solids obtained at the slightly higher temperature. (tr-auth)

8417

PYROPHOSPHATES OF THORIUM, CERIUM, AND GERMANIUM. M. Lucco Borlera and A. Burdese. Atti accad. sci. Torino. Classe sci. fis. mat. e nat. 94, 89-96(1959-60) (Pub. 1960). (In Spanish)

The pyrophosphates of Th, Ce^{4+}, and Ge belonging to the isomorphic series of cubic pyrophosphates of the type $Me^{4+}P_2O_7$ were prepared. From the spectrograms the following lattice constants were calculated: ThP_2O_7 (a_0 = 8.721A); CeP_2O_7 (a_0 = 8.338A); and GeP_2O_7 (a_0 = 7.520A). (tr-auth)

8418

RESEARCH ON ANHYDROUS ZIRCONIUM PHOSPHATE. A. Burdese and M. Lucco Borlera. Atti accad. sci. Torino. Classe sci. fis. mat. e nat. 94, 97-106(1959-60) (Pub. 1960). (In Spanish)

The system ZrO_2–P_2O_5 was studied by examining solids obtained by various methods. In addition to the already known compounds ZrP_2O_7 and $(ZrO)_2P_2O_7$ having molecular ratios ZrO_2/P_2O_5 of 1:1 and 2:1, respectively, two other well-defined anhydrous phosphates were identified by x-ray methods. Of these, one is made up of a second crystalline form of zirconyl pyrophosphate (2:1) stable up to 1150°C, and the other is zirconium orthophosphate $Zr_3(PO_4)_4$ (3:2). The latter can be obtained in the metastable state by heating beyond 800°C with suitable precipitation products. (tr-auth)

8419

RESEARCH ON THE SYSTEM THORIUM OXIDE–PHOSPHORIC ANHYDRIDE. A. Burdese and M. Lucco Borlera. Atti accad. sci. Torino. Classe sci. fis. mat. e nat. 94, 107-20(1959-60) (Pub. 1960). (In Spanish)

A systematic study was made of the solids of the system ThO_2–P_2O_5. Among the compounds already noted, $Th(PO_3)_4$, ThP_2O_7, and $Th_3(PO_4)_4$, there were two other anhydrous phosphates having the ThO_2/P_2O_5 ratio of 2:1 and 3:1. A study was also made of the conditions for formation and regions of stability of these various compounds. In particular, ThP_2O_7 existed in three different crystalline forms as demonstrated by x-ray and dilatometric methods. (tr-auth)

8420

INFRA-RED SPECTRA OF URANYL COMPOUNDS. I. URANYL NITRATES. J. G. Allpress (Univ. of Melbourne) and A. N. Hambly (University Coll., Canberra, Australia). Australian J. Chem. 12, 569-74(1959) Nov.

The infra-red spectra of the di-, tri-, and hexahydrates of uranyl nitrate and of anhydrous potassium uranyl nitrate have been recorded. The results differ significantly from those of Gatehouse and Comyns but did not permit a decision regarding the structure of the complex anions in these compounds. (auth)

8421

ELECTRODE POTENTIALS OF URANIUM IN MOLTEN SALTS. W. Trzebiatowski and A. Kisza (Technical Univ., Wrocław, Poland and Inst. of Physical Chemistry, Polish Academy of Sciences, [Wrocław]). Bull. acad. polon. sci., Ser. sci., chim., géol. et géograph. 7, 781-7(1959). (In English)

The emf of two electrolytic cells, the first consisting of $U/UCl_3-AgCl/Ag$ and the second of Pt/UCl_3, UCl_4-AgCl/Ag was determined at various uranium ion concentrations between 650 to 850°K, using the eutectic LiCl–KCl mixture as solvent. From these values the standard potentials E_x^0 against the silver/silver chloride electrode were extrapolated and determined to be +1.587 v at 673°K for the first and +0.186 v for the second cell. The temperature dependence of the equilibrium constants of these reactions permitted calculation of the enthalpies of the cell reactions which were −113.3 kcal/mol and −6.3 kcal/mol respectively. These values revealed through simple thermodynamical calculations the E_x^0 of U/UCl_4 and ΔH of the cell reaction $U/UCl_4-AgCl/Ag$ which were +1.236 v and −107.0 kcal/mol, respectively. (auth)

8422

DETERMINATION OF THE SUBLIMATION HEAT OF BORON BY MASS SPECTROMETRY. P. A. Akishin, O. T. Nikitin, and L. N. Gorokhov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 129, 1075-8(1959) Dec. 11. (In Russian)

An attempt is made to determine the sublimation heat of crystalline boron by a method combining the evaporation from an effusion chamber with mass spectrometric determination of the composition and absolute vapor pressure. The results indicate the sublimation heat $\Delta H_5^0 = 131.6 \pm 5$ kcal/g atom. (R.V.J.)

8423

ON THE REACTIVITY OF URANOURANIC OXIDE. I. ON THE THERMAL DECOMPOSITION OF URANYL NITRATE (UNH), AMMONIUM DIURANATE (ADU) AND URANIUM PEROXIDE (UPO). R. Ukazi (Osaka Metal Ind. Co.). J. Atomic Energy Soc. Japan 1, 405-11(1959). (In Japanese)

Uranouranic oxides prepared from uranium compounds by various methods were physically and chemically examined. It is concluded that uranouranic oxide obtained from UPO is the most reactive, and that the difference of these reactivities does not depend upon impurities, but essentially upon some physical properties, such as the specific surface area and the crystal structure. A comparative study is presented of the mechanism on the thermal decomposition of UNH, ADU, and UPO by a semi-automatic recording thermal balance, an x-ray diffractometer and its high-temperature apparatus. The results are as follows; (1) the thermal decomposition of UNH, uranic oxide is formed in the temperature range of 320 to 570°C, and its compound may be monoclinic; (2) the thermal decomposition of ADU, uranic oxide is formed in the range of 340 to 550°C, and its product may be of a new crystal system; (3) the thermal decomposition of UPO, amorphous UO_3 is formed in the range of 320 to 500°C; the uranouranic oxides are always orthorhombic crystals. (auth)

8424

POLAROGRAPHIC STUDY OF MANGANESE, TECHNETIUM, AND RHENIUM. R. Colton, J. Dalziel, W. P. Griffith, and G. Wilkinson (Imperial Coll., London). J. Chem. Soc. 71-8(1960) Jan.

The polarographic reduction of potassium permanganate, potassium pertechnetate, potassium perrhenate, and potassium octacyanorhenate(V) was studied in aqueous solution with a variety of supporting electrolytes. The polarographic reduction of manganese and rhenium carbonyls, and carbonyl halides was studied in non-aqueous solution, a quaternary ammonium salt being used as supporting electrolyte. The valency states of (+6) and (+7) were observed for technetium. A method of purification of the element is described and several analytical procedures are suggested. (auth)

8425

PREPARATION OF URANIUM(IV) OXYACETATE AND TETRA-ACETATE. K. K. Tripathy, Balaram Sahoo, and D. Patnaik (Utkal Univ., Cuttack, India). J. Indian Chem. Soc. 36, 739-41(1959) Oct.

Uranium(IV) oxyacetate was prepared by the photochemical reduction of uranyl acetate in a mixture of acetic anhydride and alcohol. The compound obtained was a dirty green fine powder and possesses the formula $UO(CH_3COO)_2 \cdot H_2O$. Refluxing of the aquo-oxyacetate with acetic anhydride, produces anhydrous uranium(IV) tetra-acetate, $U(CH_3COO)_4$. (auth)

8426

ELECTRON PARAMAGNETIC RESONANCE OBSERVATIONS ON IRRADIATED THIOLS AND DISULPHIDES. T. Henriksen and A. Pihl (Norsk Hydro's Inst. for Cancer Research, Oslo). Nature 185, 307-8(1960) Jan. 30.

The role of sulfur in radiation damage was investigated by recent electron paramagnetic resonance studies of a series of irradiated thiols and disulfides. Irradiations were carried out in vacuum as well as air at room temperature by 220-kev x rays, at doses $< 5 \times 10^5$ r. It was found that EPR measurements are influenced by several parameters which must be clearly defined in qualitative as well as quanitative EPR studies. The distinct differences observed between the spectra of various thiols and disulfides open up the possibility of studying the chemical properties or irradiated mixed disulfides, a question which is of interest from a radiation protection point of view. (B.O.G.)

8427

THE STRUCTURE OF URANIUM ORTHOPHOSPHATE $U_3(PO_4)_4$. Aurelio Burdese and Maria Lucco Borlera (Politecnico, Turin). Ricerca sci. 29, 2537-40(1959) Dec. (In Italian)

The orthophosphate of uranium crystallizes in the monoclinic system. The unit cell containing two molecules of $U_3(PO_4)_4$ has the following constants: $a_0 = 10.78$A; $b_0 = 10.76$A; $c_0 = 9.12$A; and $\beta = 104°7'$. By oxidation one can increase the O/U ratio with respect to the theoretical, with accompanying slight diminution of the volume of the unit cell. (tr-auth)

8428

THE PYROLYSIS OF METAL ALKOXIDES. PART 2. KINETIC STUDIES ON ZIRCONIUM TETRA-TERT.-AMYLOXIDE. D. C. Bradley and M. M. Faktor (Birkbeck Coll., London). Trans. Faraday Soc. 55, 2117-23(1959) Dec.

The kinetics of the thermal decomposition of zirconium tetra-tert.-amyloxide were studied in glass at temperatures between 208 to 247°C (mostly at 218.4°). Character-

istic sigmoid pressure against time curves were obtained corresponding to a chain mechanism. The results conformed to a mechanism involving the hydrolysis of the zirconium tert.-alkoxide by water produced in the dehydration of the tert.-alcohol. (auth)

8429
HYDROGEN ATOM REACTIONS WITH TOLUENE. Ronald B. Ingalls (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.BII-9 of "The Fourth International Symposium on Free Radical Stabilization: Trapped Radicals at Low Temperatures, Held at Dunbarton College, Washington, D. C., August 31, September 1 and 2, 1959." Washington, D. C., National Bureau of Standards, [1960].

A method for measuring the activation energy of hydrogen abstraction in toluene is presented. From a quantitative determination of HD by mass spectrometric analysis, the activation energy was determined to be 2.7 kcal/mole. (C.J.G.)

8430
ATOMIC-BEAM STUDIES ON THE FORMATION OF FREE-RADICAL SOLIDS. R. T. Brackmann and Wade L. Fite (General Atomic Div., General Dynamics Corp., San Diego, Calif.). p.CV1-12 of "The Fourth International Symposium on Free Radical Stabilization: Trapped Radicals at Low Temperatures, Held at Dunbarton College, Washington, D. C., August 31, September 1 and 2, 1959. Washington, D. C., National Bureau of Standards, [1960].

Atomic-beam studies on the stabilization of atomic hydrogen at temperatures of 2.5 to 6°K were performed. The stored energy in the condensate was determined calorimetrically. When using an atomic-beam apparatus which provided currents of 10^{16} to 10^{19} particles per second, three events were observed during hydrogen gas condensation: spontaneous energy release during condensation; periodic energy release during condensation; and energy release during warm-up. (C.J.G.)

8431
IMPROVEMENTS IN OR RELATING TO THE PURIFICATION OF AQUEOUS SOLUTIONS OF ALKALI METAL COMPOUNDS. Philip Michael Cherubino Lacey and David Flower Sangster (to United Kingdom Atomic Energy Authority). British Patent 819,034. Aug. 26, 1959.

Purification of alkali metal salt solutions by contacting with an amalgam of the alkali metal is described. In an example, an aqueous solution of LiOH containing 6.1% NaOH is shaken with ⅓ its volume of Li amalgam. After 8 min of shaking the solution contained only 0.3% NaOH. (T.R.H.)

8432
IMPROVEMENTS IN OR RELATING TO METHOD OF DECOMPOSING DOUBLE SALTS BY HEAT AND APPARATUS THEREFOR. Stephen William Kenneth Morgan and Derek Anthony Temple (to United Kingdom Atomic Energy Authority). British Patent 819,302. Sept. 2, 1959.

A method and apparatus for eliminating frothing during thermolysis of such compounds as $(NH_4)_2BeF_4$ are described. In this method the double salt is spread over the hearth of a retort, the bottom of which is heated high enough to melt the solid formed by decomposition. The top is heated so that it radiates heat to decompose the salt. The retort and charge-discharge apparatus are described. (T.R.H.)

8433
METHOD FOR PRODUCING TITANIUM, ZIRCONIUM, CERIUM, HAFNIUM OR THORIUM. Stanislaw Teodor Jazwinski and Joseph Anthony Sisto (Barium Steel Corp.). British Patent 828,238. Feb. 17, 1960.

A process is described for producing metals from their oxides by forming carbonyls and distilling them off. An oxide of the metal is placed in a reaction vessel with carbon equivalent to the O_2 in the oxide and heated. Addition of CO, to a concentration of 7 moles per gram atom of metal, and a pressure of 2 atm. cause formation of a compound $M(CO)_y$ where M = the metal. This carbonyl compound is then distilled off and reduced to the pure metal. (T.R.H.)

8434
A PROCESS FOR THE PREPARATION OF METALLIC URANIUM FROM URANIUM TETRACHLORIDE BY FUSED SALT ELECTROLYSIS. (to Ministry of International Trade and Industry). British Patent 828,258. Feb. 17, 1960.

A process for fused salt electrolysis of UCl_4 to produce U is described which avoids disadvantages of similar processes by maintaining UCl_4 concentration above 10%. In one example the bath contained 1300 g UCl_4, 830 g KCl, 130 g NaCl, and 640 g LiCl. A graphite anode and Mo-wire cathode and a pyrex vessel were used. The electrolytic current was 20 amps, the voltage 6 to 9 for 322.5 amp-hr at 450 ± 20°C. In the example 575 g of very pure U was obtained at a current efficiency of 81%. (T.R.H.)

Analytical Procedures

8435 AECU-4682
Ionics, Inc., Cambridge, Mass.
PROGRESS REPORT FOR PERIOD COVERING JANUARY 15, 1960–FEBRUARY 15, 1960. Feb. 15, 1960. 6p. Contract AT(30-1)-2470. OTS.

A stepwise procedure for the radiometric determination of thorium is given, and data on analysis of standard samples are included. The average yield obtained was 87%. In order to determine the effects of possible radiochemical impurities, samples of purified U, Po, and Ra were analyzed by the thorium procedure. Minimum decontamination factors of 50,000, 6,000, and 5,000 were found for U, Po, and Ra, respectively. Analysis of spiked unknowns containing Th^{230}, Ra^{226}, and natural U were encouraging, and the procedure is scheduled for use in analysis of ore mill liquors. Development of the procedure for use in determining very low levels of Ra is in progress. (J.R.D.)

8436 CEA-1087
France. Commissariat à l'Énergie Atomique, Paris.
DOSAGE COLORIMÉTRIQUE DE L'URANIUM PAR LE THIOCYANATE D'AMMONIUM EN MILIEU ACÉTATE D'ÉTHYLE–ACÉTONE–EAU. (Colorimetric Determination of Uranium using Ammonium Thiocyanate in a Medium of Ethyl Acetate, Acetone and Water). M. Hucleux and P. Dessapt. Apr. 1959. 22p.

The méthod consists of colorimetrically analyzing uranium using ammonium sulfocyanide in the solvent phase. The optimum conditions for extracting uranium by ethyl acetate have been studied. A precise colorimetric method was established which depends on the extracted phase and on the behavior of the ethyl acetate–acetone medium. (auth)

8437 IDO-14503
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ISOTOPIC ANALYSIS OF BORON AS TRIMETHYL BORATE. R. M. Abernathey. Jan. 28, 1960. 8p. Contract AT(10-1)-205. OTS.

Boron-impregnated polyethylene tape was irradiated in the Engineering Test Reactor Critical Facility to study the effect of boron as a burnable poison in reactor fuel. Isotopic analysis of the boron was performed with a conventional CEC Model 21-103 mass spectrometer. The tape was distilled off and the residual boron was converted to trimethyl borate. The reaction mixture was analyzed without separation. Good precision was obtained with samples containing less than 0.5 mg. boron. Features of the mass spectrum of trimethyl borate are discussed. Other applications of the method are suggested. (auth)

8438 KAPL-M-JRC-2

Knolls Atomic Power Lab., Schenectady, N. Y.

PHOTOMETRIC PROCEDURES FOR THE ANALYSIS OF NUCLEAR REACTOR CORROSION PRODUCTS. J. R. Ciaranello and K. E. Combs. Dec. 16, 1959. 25p. Contract W-31-109-Eng-52. OTS.

An evaluation of photometric procedures suitable for the determination of microgram amounts of iron, nickel, chromium, manganese, and cobalt in nuclear reactor corrosion products is presented. Standard procedures were adapted for this purpose; in many cases, separations were necessary because of interferences. The analytical procedures were tested with synthetic samples of known composition and were found to give acceptable results. The methods were also applied to the analysis of corrosion products taken from nonradioactive systems. (auth)

8439 NBL-132

New Brunswick Lab., AEC, N. J.

THE POLAROGRAPHIC DETERMINATION OF URANIUM (VI) IN URANIUM TETRAFLUORIDE. M. W. Lerner and F. Jaffa. Oct. 1956. 6p. OTS.

A polarographic method, based on complete dissolution of the sample in a $HCl-H_3BO_3$ solution with a minimum of oxidation during dissolution, is described for the determination of U(VI) in UF_4. Good agreement was obtained between experimental and calculated values. (C.J.G.)

8440 PGR-58(S)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Springfields, Lancs, England.

ANALYTICAL METHOD FOR THE SPECTROGRAPHIC DETERMINATION OF LITHIUM, SODIUM AND POTASSIUM IN BERYLLIUM FLAKE AND POWDER (CARRIER DISTILLATION TECHNIQUE). 1959. 10p. BIS.

The metal is ignited to oxide. A portion of the oxide is mixed with sodium chloride as carrier for the determination of lithium and potassium and another portion of the oxide with silver chloride, as carrier for the determination of sodium. Both portions of oxide are then spectrographed by the carrier distillation technique. Spectra are evaluated by visual comparison with spectra on a standard plate. (auth)

8441 PGR-65(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE INSPECTION OF SODIUM NITRITE. 1959. 12p. BIS.

Sulfate, volatile matter, and water-insoluble matter are determined gravimetrically. The total nitrite content and acidity or alkalinity are determined volumetrically, the iron and phosphorus contents absorptiometrically, and the chloride content turbidimetrically. (auth)

8442 PGR-68(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

ANALYTICAL METHODS FOR THE DETERMINATION OF URANIUM IN URINE. 1959. 5p. BIS.

Two methods are described for the determination of uranium in urine in which the sample is evaporated and ignited, the residue fused with a sodium fluoride–sodium bicarbonate mixture, and the uranium determined fluorimetrically. One method is suitable for all concentrations of uranium in urine. The other, a more rapid procedure, is only applicable to uranium concentration of less than 10 μg per liter. (auth)

8443 PGR-78(W)

United Kingdom Atomic Energy Authority. Production Group. Chemical Services Dept., Windscale, Sellafield, England.

THE RADIOCHEMICAL DETERMINATION OF RUTHENIUM 103 AND 106 IN REACTOR FUEL PROCESSING AND PLANT SOLUTIONS. Dec. 1959. 11p. BIS.

A method for determining Ru^{103} and Ru^{106} in solutions containing mixed fission products is presented. Interchange between added carrier and radioruthenium in the sample is effected by boiling in alkaline solution in the presence of an oxidant. Ruthenium is extracted as tetroxide into carbon tetrachloride and precipitated as the dioxide. After mounting on stainless steel trays, the beta and gamma activities are measured. The observed activities are corrected for the chemical yield of the separation procedure, determined by absorptiometric measurement of a solution prepared from the source after counting. (auth)

8444 USNRDL-TR-388

Naval Radiological Defense Lab., San Francisco.

RADIOCHEMICAL ANALYSES THROUGH POLAROGRAPHIC METHODS. II. A RAPID PROCEDURE FOR TECHNETIUM AND RUTHENIUM RADIONUCLIDES IN FISSION PRODUCTS. D. L. Love and A. E. Greendale. Nov. 24, 1959. 27p.

An electrochemical determination for Tc^{99m} in fission product mixtures was developed. The precision and accuracy of this method are better than the regular radiochemical methods and approximately fifty analyses may be made in one day. The number of fissions and the quantity of Mo^{99} are determined from the quantity of Tc^{99m} found in the fission product mixture. (auth)

8445 CEA-tr-A-633

UNE MÉTHODE DE DOSAGE PHOTOÉLECTRIQUE DU THALLIUM. (A Method for the Photoelectric Determination of Thallium). H. Zimmer. Translated into French from Z. anal. Chem. 165, 268(1959). 8p.

A method for determining Tl is described which is based on the precipitation of Tl^+ in the difficulty soluble chromate state. The precipitate, after filtering and washing, is dissolved in HCl, and the chromate in solution is determined photoelectrically after addition of diphenylcarbazide. The method gives exact values even in the presence of alkaline ions and of small quantities of several other metal ions. The method has been chosen for analysis of organic compounds of Tl and for determination of Tl in corrosion products. (tr-auth)

8446 CEA-tr-R-746

DÉTERMINATION SPECTROGRAPHIQUE DES TRACES DE TANTALE DANS LE PENTOXYDE DE NIOBIUM. (Spectrographic Determination of Tantalum Traces in Niobium Pentoxide). N. I. Tarasevich (Tarassevich), A. A. Zheleznova (Jeleznova), and K. A. Semenenko. Translated into French by B. Vinogradoff from Vestnik Moskov. Univ., Ser. Mat., Mekh., Astron., Fiz. i Khim. 12, No. 1, 156–8 (1957). 5p.

A spectrographic method for Ta in Nb_2O_5 between 1.5 and 0.3% is described. Standards are prepared by calcining Nb powder at 850°C and adding Ta in HNO_3 or Hf solution and recalcining at 850°C. The electrodes are of 6-mm graphite, the lower one being cupped and the upper one being a truncated cone. A KS-SS spectrograph was used with type-1 spectral or diapositive photographic plates. The 2714.674A line of Ta and the 2714.198A line of Nb were used. The relative error for the method is ±12% for mimimum concentration. (T.R.H.)

8447

THE ABSOLUTE ASSAY OF SULFUR-35 BY INTERNAL GAS COUNTING. W. F. Merritt and R. C. Hawkings (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Anal. Chem. 32, 308-10(1960) Mar.

A method is described for measuring the absolute disintegration rate of 87.2-day sulfur-35, (β-E_{max}= 0.167 Mev). The sulfur to be assayed is converted to sulfur dioxide by ignition of barium sulfate with red phosphorus in an atmosphere of oxygen. The sulfur dioxide is then mixed with methane and counted in an internal gas proportional counter. (auth)

8448

THE ABSOLUTE COUNTING OF SULFUR-35. Janet S. Merritt, J. G. V. Taylor, W. F. Merritt, and P. J. Campion (Atomic Energy of Canada Ltd., Chalk River, Ont.). Anal. Chem. 32, 310-13(1960) Mar.

Several methods for determining the absolute disintegration rate of a stock solution of sulfur-35 are presented and compared. These include differential gas counting as sulfur dioxide, $4\pi\beta$ counting with suitable corrections, and a tracer method. A technique is described for preparing sources for $4\pi\beta$ counting in which a minute quantity of colloidal silica is added to improve the uniformity of the deposit. The corrections associated with $4\pi\beta$ counting are described, the largest being that due to self-absorption. In the tracer method, a β-γ-emitting nuclide suitable for coincidence counting is combined with the sulfur-35 and used as a tracer to follow the efficiency for counting sulfur-35. Experimental justification for this method is presented. The mean of these independent determinations has a standard deviation of about 1%. (auth)

8449

DETERMINATION OF OXIDES IN FLUORIDE SALTS BY HIGH-TEMPERATURE FLUORINATION WITH POTASSIUM BROMOTETRAFLUORIDE. Gerald Goldberg, A. S. Meyer, Jr., and J. C. White (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 314-17(1960) Mar.

A method is described for the determination of oxygen in fluoride salts of yttrium, beryllium, zirconium, and magnesium and in mixtures of these salts with the fluoride salts of sodium and lithium. The fluorinating agent, potassium bromotetrafluoride, which is prepared in a nickel reactor by the addition of bromine trifluoride to potassium fluoride, is reacted with the oxides for 2 hours at 450°C to produce oxygen which is then measured tensimetrically. Recovery of oxygen from the pure metal oxides as standards is better than 98% with a coefficient of variation of less than 5%. The precision of analysis of the fluoride salts is better than 10%. The range of oxygen that can be measured is from 0.02 to 10 mg. (auth)

8450

INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS. V. P. Guinn and C. D. Wagner (Shell Development Co., Emeryville, Calif.). Anal. Chem. 32, 317-23(1960) Mar.

A system of instrumental neutron activation analysis in which no chemical operations are employed is described. It consists of neutron activation followed by γ-ray spectrometry. Even with the relatively low thermal neutron flux available from a Van de Graaff accelerator photoneutron source (10^8 neutrons sec^{-1} cm^{-2}), useful analyses were carried out for more than 25 elements, in many cases with sensitivities in the parts-per-million range. In general, the method is much faster than chemical or spectroscopic methods of equal sensitivity and accuracy; it is nondestructive and is relatively free of serious interferences. No sample preparation is involved. Activation plus counting total only about 10 minutes per sample. (auth)

8451

DETERMINATION OF HYDROCARBON OXIDATION PRODUCTS. REVERSE ISOTOPE DILUTION ANALYSIS. William H. Clingman, Jr. and Harold H. Hammen (American Oil Co., Texas City, Tex.). Anal. Chem. 32, 323-5(1960) Mar.

To determine the products from the radiation-induced oxidation of propane, reverse itosope dilution analysis was investigated. The analytical data demonstrated that individual members of a homologous series may be determined without interference from each other by using recrystallization of a suitable derivative as the purification method. If only one compound in the sample is determined, there need be no separation of products prior to this final purification. The method should find application in analysis of hydrocarbon oxidation products. (auth)

8452

DETERMINATION OF TRACES OF OXYGEN IN SODIUM METAL BY INFRARED SPECTROPHOTOMETRY. H. J. deBruin (Australian Atomic Energy Commission, Lucas Heights, New South Wales). Anal. Chem. 32, 360-2(1960) Mar.

A method for the determination of traces of oxygen in sodium metal by infrared spectrophotometry is presented. Procedures to a lower limit of 20 ppm with an accuracy to ±20% are detailed. A Wurtz reaction, employing n-amyl chloride, is followed by the application of the infrared pressed disk technique to the solid reaction products, which contain the oxygen impurity. The carbonate absorbance band at 11.38 μ, due to the conversion of the original sodium monoxide to carbonate by atmospheric carbon dioxide, follows the Lambert-Beer law between 0 and 300 ppm. A method is suggested for handling of samples, contained in glass ampoules. (auth)

8453

THIOMALIC ACID AS REAGENT FOR ZIRCONIUM. Suseela B. Sant (Mount Holyoke Coll., South Hadley, Mass.) and Bharat R. Sant (Louisiana State Univ., Baton Rouge). Anal. Chem. 32, 379-80(1960) Mar.

Thiomalic acid is shown to be a suitable reagent for the quantitative precipitation of zirconium from dilute nitric or hydrochloric acid solution. Common anions like chloride, sulfate, and nitrate and most of the cations do not interfere. Interferences due to mercury(II) and thorium are easily eliminated. Bismuth is coprecipitated and is the only interfering element which must be eliminated by prior separation. The composition of the zirconium compound varies somewhat but corresponds approximately to zirconyl thiomalate. (auth)

8454

A CONTINUOUS GAS TITRATION ANALYZER FOR FLUORINE. C. W. Weber (Oak Ridge Gaseous Diffusion Plant, Tenn.). Anal. Chem. 32, 387-91(1960) Mar.

An automatic fluorine analyzer was developed for precise continuous monitoring and control of complex gas

systems. Based upon pneumatic detection of the reduction in molar flow as fluorine reacts with sulfur dioxide, the analyzer is precise to ±1% fluorine. Excellent on-stream performance is achieved in the presence of uranium hexafluoride, hydrogen fluoride, and oxygen. (auth)

8455

DETERMINATION AND REACTIONS OF SOME ACIDIC OXY-ANIONS IN FUSED CHLORIDES AND NITRATES. J. D. Van Norman and R. A. Osteryoung (Rensselaer Polytechnic Inst., Troy, N. Y.). Anal. Chem. 32, 398-400 (1960) Mar.

A method has been developed for determining acidic oxy-anions, such as dichromate, metaphosphate, or metavanadate, in fused chlorides and nitrates by determining the number of moles of carbon dioxide evolved when excess sodium carbonate is added to a fused salt containing one of these species. The method determines the acidic species in situ and is reasonably accurate. The relationship of acid-base reactions to oxidation-reduction processes in fused salts is discussed. (auth)

8456

SIMPLE FLUORESCENT INTENSIFICATION SCREEN FOR ULTRAVIOLET SCANNER CAMERAS. Donald F. Petersen and Arthur Murray, III (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 32, 443(1960) Mar.

Filter paper saturated with 1-methyl-4-(5-phenyl-2-oxazolyl)- pyridinium-p- toluenesulfonate was found to have application as a fluorescent intensification screen for an ultraviolet scanner camera. The device was successfully used for identification of purine and pyrimidine nucleotide derivatives. (C.J.G.)

8457

THE CONVERSION OF OXYGEN IN COMPOUNDS TO WATER FOR ISOTOPIC ANALYSIS BY A DENSITY TECHNIQUE. I. Lauder and I. R. Wilson (Univ. of Queensland, Brisbane). Australian J. Chem. 12, 613-20(1959) Nov.

A method is described which enables oxygen in numerous compounds to be isolated in the form of water as a preliminary step to the determination of the isotopic composition of the oxygen by a density technique. The oxygen in the compound is converted to carbon monoxide or dioxide. These gases are reduced by hydrogen in the presence of a pure nickel catalyst to yield water and hydrocarbons. A small memory effect is shown, but this is eliminated by the first sample put through the process. The process can be carried out on a scale such that 1 mm of water is produced for each reduction. The time involved is about 2 hr per sample. (auth)

8458

THE CONVERSION OF OXYGEN IN COMPOUNDS TO CARBON MONOXIDE FOR MASS-SPECTROMETRIC ANALYSIS. I. Lauder and B. Zerner (Univ. of Queensland, Brisbane). Australian J. Chem. 12, 621-9(1959) Nov.

A method by which oxygen in many organic compounds and some inorganic compounds can be converted to carbon monoxide for mass-spectrometric analysis is described. The compound is decomposed in the vapor state in the presence of excess bromine by contact with a clean or a carbon-coated platinum wire at a bright red heat. The bromine acts as a scavenger and removes hydrogen and hydrocarbons. Carbon monoxide is obtained quantitatively and may be isolated in a pure state, except when the compound contains nitrogen, by freezing out the other decomposition products using liquid air. Memory and dilution effects are very small. (auth)

8459

THE MASS-SPECTROMETRIC ANALYSIS OF OXYGEN IN CARBON MONOXIDE AND CARBON DIOXIDE. I. Lauder (Univ. of Queensland, Brisbane). Australian J. Chem. 12, 630-6(1959) Nov.

Results of measurements of oxygen-18 abundances in carbon monoxide and carbon dioxide using a Nier-type isotope-ratio mass spectrometer are given. Carbon monoxide is a far superior gas to carbon dioxide as a carrier for the oxygen isotopes because of the more rapid pump-out and almost complete absence of memory in the mass spectrometer. The slight variation of the measured ratio with output voltage is attributed mainly to the non-ohmic response of the grid resistors to the electrometer valves. (auth)

8460

FUNCTIONAL ERRORS IN THE METHOD OF DETERMINATION BY ISOTOPIC DILUTION. Philippe Lebreton (Laboratoire de Chimie Biologique, Lyon). Bull. soc. chim. France No. 1, 179-81(1960) Jan. (In French)

The statistical nature of the emission of radioelements limits the precision of determinations by isotopic dilution. Theoretical considerations supported by an experimental model were used to study the optimum conditions for radiochemical work on a given problem in which the technique of counting at predetermined times is used. (tr-auth)

8461

PHOTONEUTRONIC METHOD OF DETERMINING THE CONCENTRATION OF DEUTERIUM IN NATURAL WATER. V. I. Baranov, V. K. Khristianov, and B. V. Karasev. (Doklady Akad. Nauk S.S.S.R. 129, 1035-7(1959) Dec. 11. (In Russian)

The deuterium concentration in water was determined with an order of accuracy of ±1% by correlating the corresponding γ radiation source power with an effective neutron attenuation method. The analyzed water was irradiated by γ quanta, and the neutron flux produced by $D^2(\gamma,n)H^1$ reactions was recorded. The threshold of the reaction is 2.22 Mev, and the cross section is 1.2×10^{-27} cm^2. Under ordinary conditions the number of neutrons emitted is proportional to the deuterium concentration. The comparison experiments used a Na^{24} γ source with Be emitting the neutrons. The cross sections of (γ,n) for D_2O and Be are almost identical. Descriptions are given of the installation and the procedures. (R.V.J.)

8462

SOURCE FOR ISOTOPIC ANALYSIS OF CHLORINE. E. A. Bakulin and E. V. Stepin (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 138-9(1959) Sept.-Oct. (In Russian)

A mass spectrometer source is described for use in determining the isotopic composition of small amounts of chlorine (up to 10^{-7} g). (tr-auth)

8463

LIQUID SCINTILLATION COUNTING OF AQUEOUS SOLUTIONS OF CARBON-14 AND TRITIUM. Jacob Shapira and William H. Perkins (Veterans Administration Hospital, Little Rock, Ark.). Science 131, 414-15(1960) Feb. 12.

A method is reported whereby aqueous solutions containing weak beta emitters are dispersed as stable emulsions in liquid scintillator counting solutions. The method permits the routine counting, with about 10% efficiency, of large numbers of samples containing tritium and C^{14}. Self-absorption does not present a problem when less than 5% aqueous phase is present. (auth)

8464

SPECTRAL ANALYSIS OF PURE MATERIALS. L. V. Lipis. Soviet Phys.–Uspekhi 2, 393-9(1959) May-June.

The historical development of spectral analysis is discussed, using boron to show the advances made. (C.J.G.)

8465

A METHOD AND APPARATUS FOR DETERMINING THE QUANTITY OF HYDROGEN IN METAL SAMPLES. William Warren Triggs (Marks and Clerk). British Patent 827,018. Jan. 27, 1960.

A vacuum distillation method and device for determining H_2 in metals are described. An evacuated system comprising a sample loader, furnace, sample disposal container, and gas measuring McCleod gage all connected together is described. The samples are placed in a side arm tube above the furnace area from which they are discharged by magnetic manipulation of an iron pusher. The samples are pushed onto a bucket which is lowered into the furnace region for the determination. After all the H_2 has been evolved and measured, the sample is dumped to a container below the furnace for removal. In the method described the sample is not melted. The H_2 can be measured as the final pressure in the system or as a plot of pressure versus time. (T.R.H.)

Radiation Chemistry

8466 AD-215183

North Carolina State Coll., Raleigh.

INVESTIGATION OF THE EFFECT OF NUCLEAR RADIATION ON THE VERDET CONSTANT OF SILVER NITRATE SOLUTION (thesis). Morris Harold Bradshaw. 1958. 67p.

A 1 molar solution of silver nitrate solution was exposed to nuclear radiation in the Raleigh Research Reactor for varying dosages. The Verdet constant of the solution was measured before irradiation and after 5, 10, and 15 hours of irradiation at 100 watts indicated reactor power. The transmissivity of the solution after 15 hours irradiation was measured with a spectrophotometer. Curves are given showing the change in the Verdet constant and the transmission spectrum of the solution with irradiation. The Verdet constant of the solution was found to decrease exponentially with increased radiation dosage, asymptotically approaching that of the solvent, water. The transmission spectrum indicated the irradiation produced a decrease in concentration with metallic silver precipitating out of the solution. (auth)

8467 AECU-4679

Air Reduction Sales Co., Inc. Central Research Labs., Murray Hill, N. J.

RESEARCH ON KRYPTON 85. Monthly Progress Report No. 7 covering December 1, 1959 to December 31, 1959. H. S. Miller, W. G. Marancik, and J. Zufall. Jan. 21, 1960. 4p. Contract AT(30-1)-2343. OTS.

In a test involving irradiation of about 22 g of styrene with krypton-85, less than a milligram of styrene polymer was found after 24 hours. In other tests 1.58 g of polymer was produced per curie of krypton-85. All of the krypton was recovered after these experiments. The average softening points of polymers formed at room temperature and 71 and −79°C ranged from 76 to 57°C, while molecular weights ranged from 178,000 to 400,000. Electrical tests were made in the range above 2000 volts with krypton-85 mixtures and inactive krypton–nitrogen mixtures; with krypton-85 concentrations as high as 1% (0.5 curie/liter) no significant difference in breakdown potential was found. (For preceding period see AECU-4510.) (J.R.D.)

8468 NP-8361

Polish Academy of Sciences. Inst. of Nuclear Research. Warsaw.

THE POSSIBILITY OF RADIATION NITRATION OF AROMATIC HYDROCARBONS. Report No. 123/ChR. R. Broszkiewicz, S. Minc, and Z. Zagórski. Dec. 1959. 3p.

A solution of benzene in water containing calcium nitrate was irradiated with gamma rays in a closed aluminum vessel. Nitrobenzene was produced in considerable yield. Equations are proposed for the reaction. (C.J.G.)

8469 NYO-2605

Air Reduction Co., Inc. Central Research Labs., Murray Hill, N. J.

FISSION PRODUCT APPLICATIONS USING GASEOUS BETA SOURCES. Quarterly Progress Report No. 3 [for] September 1, 1959 to November 30, 1959. Hoke S. Miller and John H. Zufall. 19p. Contract AT(30-1)-2343. OTS.

Tests on the effects of krypton-85 on the oxidation of HCl to chlorine and water show negative results. Preliminary tests show that krypton-85 initiates the polymerization of styrene. The krypton-85 was recovered with satisfactory efficiency. Apparatus for investigating the effects of krypton-85 on the breakdown voltages of gases was completed. (For preceding period see NYO-2604.) (auth)

8470 AEC-tr-3985

RADIOLYTIC REDUCTION OF AMERICIUM(VI) AND AMERICIUM(V). (Radioliticheskoe Vosstanovlenie Ameritsiya(VI) i Ameritsiya(V)). A. A. Zaitsev, V. N. Kosyakov, A. G. Rykov, Yu. P. Sobolev, and G. N. Yakolev. Translated by Helen J. Chick and James S. Coleman (Los Alamos Scientific Lab.) from a Russian report (NP-7515). 28p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14338.

8471

CHEMICAL TRANSFORMATIONS ASSOCIATED WITH THE $N^{14}(n,p)C^{14}$ NUCLEAR REACTION. Claude Brunello and Roland Muxart (Institut du Radium, Arcueil, France). Bull. soc. chim. France No. 1, 16-21(1960) Jan. (In French)

A study was made of the molecules of quinoline-C^{14}, isoquinoline-C^{14}, naphthalene-C^{14}, naphthol-C^{14}, and oxalic acid-C^{14} formed by neutron irradiation of quinoline oxalate, quinoline, and isoquinoline. To explain the observed divergences from the statistical theory of Wolf, it is shown, using a theory based on the non-equivalence of the different atoms in a heterocyclic nitrogen-containing molecule, that the probability which a molecule has of returning to the stable state after substitution varies with the position of substitution. (tr-auth)

8472

IRRADIATION TECHNIQUES IN CHEMICAL PROCESSING. J. W. Ranftl (General Electric Co.). Chem. Eng. Progr. 56, No. 2, 96; 98; 100(1960) Feb.

Cross-linking produced by the irradiation of polyethylene raises the melting point, increases its resistance to chemical solvents and to environmental stress cracking, and greatly extends the usefulness of certain products. A conceptual design is present for a practical, economic irradiation facility which is within reach of the smaller chemical producing companies. The layout of a typical irradiation facility is presented including space requirements, shielding, radiation dosages, and capital costs of the establishment. (B.O.G.)

8473

LOW TEMPERATURE RADIOLYSIS OF HYDROCARBONS. V. G. Berezkin, I. M. Kustanovich, L. S. Polak, A. V. Topchiev, and N. J. Cherniak (Inst. of Oil Chemical Synthesis, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 129, 1042-5(1959) Dec. 11. (In Russian)

An analysis was made of the effects of reduced temperature and phase conditions on the yield of various radiolysis products. The yields of hydrogen, methane, and other hydrocarbons at various temperatures are tabulated. (R.V.J.)

8474

CARBOXYLATIONS EFFECTED BY IONIZING RADIATION. B. C. McKusick, W. E. Mochel, and F. W. Stacey (E. I. du Pont de Nemours and Co., Wilmington, Del.). J. Am. Chem. Soc. 82, 723-5(1960) Feb. 5.

Irradiation of a mixture of a hydrocarbon and carbon dioxide with high-energy electrons gives carboxylic acids. For instance, toluene is converted to phenylacetic acid. The radiation energy is used inefficiently (G = 0.01 – 0.1). Formic acid can be used in place of carbon dioxide to obtain carboxylic acids. Irradiation of a mixture of a hydrocarbon and hydrogen cyanide leads to nitriles. (auth)

8475

CUBIC AND OCTAHEDRAL ETCH PITS IN ALUMINIUM. M. Allbutt (Coll. of Tech., Birmingham, Eng.). J. Inst. Metals 88, 190(1959) Dec.

An etching reagent for aluminum was prepared by the solution of HCl gas in a solvent consisting of 90 wt.% dioxane ($C_4H_8O_2$) and 10 wt.% water. The reagent was applied to 99.99% Al previously chemically polished in a phosphoric acid/nitric acid mixture at 25°C. If the concentration of HCl was less than 6M, cubic etch pits formed and for concentrations greater than 6M, octahedral etch pits formed. (C.J.G.)

8476

RADIATION GRAFT COPOLYMERIZATION IN AQUEOUS DISPERSION. W. Cooper, P. R. Sewell, and G. Vaughan (Dunlop Research Centre, Birmingham, Eng.). J. Polymer Sci. 41, 167-76(1959) Dec.

The rates of polymerization of monomers in rubber in aqueous dispersion are higher than in the corresponding bulk polymerizations. The higher rates, which are independent of latex concentration over the range of concentration studied, were attributed to the ingress of free radicals from a certain volume of the aqueous phase surrounding each particle. The γ-radiation-initiated graft polymerization of styrene with rubber is similar to that with methyl methacrylate, though the fraction of grafted polymer is lower. In the photoinitiated systems, styrene behaves differently from methyl methacrylate in that the rate of polymerization diminishes at higher monomer concentrations. (auth)

8477

THE EFFECT OF POLYMER COMPOSITION ON RADIATION-INDUCED CROSSLINKING. Edward Witt (B. F. Goodrich Co. Research Center, Brecksville, Ohio). J. Polymer Sci. 41, 507-18(1959) Dec.

The gelation induced by Co^{60} gamma radiation in butadiene–styrene copolymers, homopolymers, and mixtures of these homopolymers was studied by use of random crosslinking theory. The number of crosslinks formed per 100 ev of energy absorbed by the polymer, G(X), was found to be 0.045 for polystyrene and 3.6 for polybutadiene. The behavior of styrene units in copolymers and physical mixtures of butadiene and styrene homopolymers was different for the two polymer systems. Gel measurements showed that in the copolymer system there was a transfer of radiation energy from butadiene to styrene units, whereas there was no energy transfer in mill- and latex-prepared physical mixtures. It was further determined that terpolymerization of methyl methacrylate with butadiene and styrene induces some chain scission within the polymer chain when it is irradiated, thereby lowering further the net crosslinking of the resulting polymer. (auth)

8478

γ-IRRADIATION OF SOLID HEXAMETHYLCYCLOTRISILOXANE. W. Burlant and C. Taylor (Ford Motor Co., Dearborn, Mich.). J. Polymer Sci. 41, 547-9(1959) Dec.

The effects of γ rays on the solid phase of hexamethylcyclotrisiloxane were investigated to determine if an ionic or a free radical mechanism is obtained for the polymerization. At total doses below 5.0×10^5 rep only soluble polymer forms. The discontinuity with respect to temperature appears related to the spatial arrangement of monomer molecules in the crystal. Viscosity measurements indicate that the molecular weight increases with time. The dose rate (2.5×10^5 rep/hr) dependence differs markedly from that reported from electron-initiated polymerization. Aside from the conclusion that the polymerization is complex, it appears that a radical propagation step for the γ-ray-induced polymerization is unlikely and that ring opening may be initiated by an ionic species. (B.O.G.)

8479

ORGANIC HYDROXY-HYDROPEROXIDES: A CLASS OF HYDROPEROXIDES FORMED UNDER THE INFLUENCE OF IONIZING RADIATIONS. George Scholes and Joseph Weiss (King's Coll., Newcastle-upon-Tyne, Eng.). Nature 185, 305-6(1960) Jan. 30.

It was found that many substances, when irradiated with γ rays or x rays in aqueous solution in the presence of oxygen, form hydroxy-hydroperoxy compounds. Compounds of this class may be formed from different pyrimidine bases, for example, thymine and uracil. The thymine hydroxy-hydroperoxide is rather stable and can be isolated from the irradiated solutions. Uracil forms a corresponding hydroxy-hydroperoxide which is of comparable stability. The hydroperoxide from cytosine appears to be much less stable in solutions. A group of hydroxy-hydroperoxides was obtained from steroids by means of ionizing radiations. Peroxides from steroids attracted some interest as possible sources of the carcinogenic effects of such substances. With regard to some simpler olefinic molecules, it is of interest to note that propylene forms a hydroxy-hydroperoxide in a comparatively high yield, when irradiated in aqueous solutions in the presence of oxygen. In general, the action of ionizing radiations on ethylenic systems in the presence of oxygen can give rise to more or less stable hydroxy-hydroperoxide compounds. (B.O.G.)

8480

ENGINEERING METHODS FOR ELECTRON-BEAM PROCESSING. D. A. Trageser (High Voltage Engineering Corp., Cambridge, Mass.). Nuclear Instr. and Methods 6, 26-32 (1959) Dec. (In English)

Methods for improving electron-beam processing of industrial products are discussed. Three techniques discussed include: beam inversion, intermittent filters, and techniques for irradiating pressurized fluids in continuous flow at elevated temperatures. Designs are given for a processing installation which uses a shallow pit with local shielding around the point of beam application. (C.J.G.)

8481

THE EFFECTS OF IONIZING RADIATION ON CALCIUM NITRATE SOLUTIONS. R. G. Sowden (Atomic Energy Re-

search Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc. 55, 2084-95(1959) Dec.

Calcium nitrate solutions were irradiated in a nuclear reactor with a mixture of fast neutrons and gamma rays, and with fission recoil fragments, over a wide range of nitrate concentrations. The main products of fast neutron + gamma irradiation were nitrite, oxygen, and hydrogen, plus a small yield of nitrogen from more concentrated solutions. Nitrite yields varied erratically with dose, but hydrogen yields were linear up to energy deposition values of 7×10^{22} eV/g of solution. G_{H_2} was markedly dependent upon nitrate concentration, and decreased a factor of 40 over the concentration range 0.0008 to 15.9 M, the data obeying the empirical equation $G_{H_2} = 0.84 - 0.65\ [NO_3^-]^{\frac{1}{2}}$, up to a concentration of 1 M. Fission recoil irradiation produced no nitrite, but greatly increased the nitrogen yield. G_{N_2} fell rapidly with nitrate concentration, and below 4 M obeyed the relationship $G_{N_2} = 0.004\ [NO_3^-]^{1.5}$. G_{H_2} for fission recoils fell a factor of 8 over the concentration range 0.05 to 9.6 M, and obeyed the equation $G_{H_2} = 2.0 - 0.8\ [NO_3^-]^{\frac{1}{2}}$ over the complete range. The theoretical significance of the hydrogen yields is discussed. (auth)

8482

A CALORIMETRIC STUDY OF TRAPPED RADICALS PRODUCED BY GAMMA RADIATION. Raymond L. Arnett, Eugene D. Guth, and Julius R. Berreth (Phillips Petroleum Co., Bartlesville, Okla.). p.CII1-14 of "The Fourth International Symposium on Free Radical Stabilization: Trapped Radicals at Low Temperatures, Held at Dunbarton College, Washington, D. C., August 31, September 1 and 2, 1959." Washington, D. C., National Bureau of Standards, [1960].

Trapped radicals produced by gamma irradiation of Ar, NH_3, and N_2 at liquid helium temperatures were studied by means of an adiabatic calorimeter. For doses of approximately 100 to 200 j per g, the stored energy, in terms of % of absorbed gamma energy, was 4% for NH_3, approximately 1% for Ar, and 6.7% for N_2. The results suggest that the trapped species are in their ground state when generated in gamma-irradiated solids. A comparison of the results with those obtained from condensing an electrodeless discharged gas is made. (C.J.G.)

8483

ELECTRON SPIN RESONANCE SPECTROSCOPY OF RADICALS FORMED BY X-IRRADIATION OF AMINO ACIDS AND RELATED COMPOUNDS. C. A. McDowell and A. J. Horsfield (Univ. of British Columbia, Vancouver). p.DIV1-6 of "The Fourth International Symposium on Free Radical Stabilization: Trapped Radicals at Low Temperatures, Held at Dunbarton College, Washington, D. C., August 31, September 1 and 2, 1959." Washington D. C., National Bureau of Standards, [1960].

The radicals formed as a result of irradiation of amino acids were studied by means of electron spin resonance spectra. The free radical produced in glycine was determined to be the $NH_3^+-CH-CO_2^-$; in [$\alpha\alpha-d_2-$]glycine, the $NH_3^+-CD-CO_2^-$ radical; and in β-alanine, the $NH_3^+-CH_2-CH\ CO_2^-$ radical. (C.J.G.)

8484

INTERCONVERSIONS OF IONS AND RADICALS IN RADIOLYSIS. V. L. Tal'rose and E. L. Frankevitch (Academy of Sciences, Moscow). p.FII1-17 of "The Fourth International Symposium on Free Radical Stabilization: Trapped Radicals at Low Temperatures, Held at Dunbarton College, Washington, D. C., August 31, September 1 and 2, 1959." Washington, D. C., National Bureau of Standards, [1960].

A discussion is presented on the mechanisms of free radical production in gas and condensed phase radiolysis. It is concluded that in gas phase radiolysis the free radicals are essentially products of ion conversion reactions and in condensed phase radiolysis ions may be the products of free radical conversions. (C.J.G.)

8485

POLYETHYLENE OF IMPROVED STABILITY. (to General Electric Co.). British Patent 818,963. Aug. 26, 1959.

Radioinduced cross-linking in polyethylene is increased if the irradiation is done while in a modified state. This state is accomplished by heating to 110 or 150°C and then cooling to irradiation temperature at which crystallization would normally occur. In an example, 2-mil polyethylene film samples (m.w. = 21,100) were heated at 150°C to destroy crystallinity and cooled in 1 or 2 min to irradiation temperatures ranging from −200 to +200°C, and percent cross-linking was compared for the samples after 7.8×10^6R. The modified polyethylene had more cross-linking and more physical stability. (T.R.H.)

8486

IRRADIATION OF POLYMERIC MATERIALS. (to Esso Research and Engineering Co.). British Patent 819,147. Aug. 26, 1959.

Molecular weight reduction by irradiation of polymers is described. In an example, polyethylene of m.w. 54,000 was prepared and irradiated to 28,736,000 γ to produce material of m.w. 10,000. The polymerization catalyst was prepared by heating $AlEt_2Cl$ with $TiCl_4$ in heptane at 50°C for 15 min. Thus, it is possible to produce very pure low molecular weight materials such as lubricant additives, film-forming materials, and molded and extruded plastics of uniform quality on a continuous basis. (T.R.H.)

8487

IRRADIATION OF POLYMERIC COMPOUNDS. (to Esso Research and Engineering Co.). British Patent 818,919. Aug. 26, 1959.

Molecular weight reduction of polymers by irradiation is described. In an example, a high molecular weight isobutylene polymer in a diluent oil was irradiated at various levels to give varying viscosities. Thus, a desired viscosity can be obtained by controlled irradiation. (T.R.H.)

Radiochemistry

8488 CF-60-2-39

Oak Ridge National Lab., Tenn.

ASSAY METHODS USED IN THE ORNL RADIOISOTOPE PROGRAM. E. I. Wyatt, H. A. Parker, S. A. Reynolds, W. S. Lyon, and R. H. Rodriguez. Feb. 1, 1960. 12p. OTS.

A brief description is given of methods used in the measurement of radioactive content of radioisotopes distributed by the Oak Ridge National Laboratory. A tabulation of the techniques employed for seventy-eight nuclear species is presented. (auth)

8489 RFP-130

Dow Chemical Co. Rocky Flats Plant, Denver.

PREPARATION OF PURE AMERICIUM. V. A. Ryan and J. W. Pringle. Jan. 8, 1960. 24p. Contract AT(29-1)-1106. OTS.

Americium may be recovered with good yield and at high purity from a HNO_3 feed material containing Am concentrations of 1 mg/l together with gross amounts of La, Fe, Pu, Al, and other elements by an ion exchange procedure. The Pu is removed by sorption onto an ion exchange

resin (Dowex 1) in a 7M HNO_3 system. The transition from a HNO_3 system to an NH_4SCN system is then made by adjusting the HNO_3 solution to proper ionic strength, loading a cation exchanger resin (Dowex 50), and subsequently eluting the resin with 5M NH_4SCN. By employing a dilute SCN wash prior to elution, a major part of the Fe impurity may be removed. Major separation of Am from impurities is obtained in the 5M NH_4SCN system by loading the thiocyanate complexes onto an anion exchange resin (Dowex 1), washing the column free of impurities including the rare earths with additional 5M NH_4SCN, and finally eluting the Am from the resin with 0.1M HCl. This eluate will contain all Am and Pu which were sorbed on the resin, plus some Al if it was originally present, and small amounts of Fe. To obtain final purification, the 0.1M HCl eluate from the thiocyanate column is dripped into strong base. Amphoteric Al remains in solution while Am, Pu, and Fe are precipitated. This precipitate is washed and then dissolved in 7M HCl. The Pu and Fe are then fixed on anion exchange resin (Dowex 1) while the purified Am solution is obtained by washing the resin column with additional 7M HCl. (auth)

8490

ELECTRODEPOSITION OF ACTINIDE ELEMENTS AT TRACER CONCENTRATIONS. Russell F. Mitchell (Tracerlab, Inc., Richmond, Calif.). Anal. Chem. 32, 326-8 (1960) Mar.

The electrodeposition of the actinides from an electrolyte of ammonium chloride–hydrochloric acid is a rapid method for recovering trace concentrations of these elements in high yield. The plating procedure produces deposits which are adherent and uniformly distributed over the area of the plate. The effects of such parameters as current density, pH of electrolyte, salt concentration, volume of electrolyte, and the time of plating on the electrodeposition are discussed. (auth)

8491

SEPARATION OF MAGNESIUM FROM SODIUM AND POTASSIUM. A TRACER STUDY. Arno H. A. Heyn (Boston Univ.) and Harmon L. Finston (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 32, 328-32(1960) Mar.

The production of magnesium-28 by pile-produced tritons simultaneously results in considerable sodium-24 contamination. The degree of contamination was determined for magnesium precipitates by precipitating magnesium ammonium phosphate, magnesium oxalate from homogeneous solution, and magnesium-8-quinolinolate both by the conventional method and from homogeneous solution. The extent of sodium and potassium coprecipitated decreased in the order: phosphate method (single precipitation) > phosphate method (double precipitation) > oxalate method > quinolinolate method > quinolinolate method from homogeneous solution. In this last case the amount of sodium coprecipitated per 69 mg of magnesium ranged from 0.02 to about 1 γ for 0.4 to 4000 mg of sodium added. Adsorption is believed to be responsible for the contamination in most cases. The results show the quantitative accuracy and reproducibility of the magnesium-8-quinolinolate procedure for precipitation from homogeneous solution. (auth)

8492

ELECTROCAPILLARY METHOD FOR DEPOSITING FINE LAYERS OF RADIOACTIVE SUBSTANCES ON ORGANIC FILMS. V. A. Gorodyskiĭ, Yu. F. Romanov, A. V. Sorokin, and M. I. Yakunin (Radium Inst. of the Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 128-30(1959) Sept.-Oct. (In Russian)

The electrocapillary method for depositing fine and sufficiently homogeneous layers of radioactive substances on organic films is described. Sources up to 3 cm in diameter are prepared on 1 $\mu g/cm^2$ films by spraying the radioactive solution from a capillary under the action of an electric field. (tr-auth)

8493

EFFICIENCY OF THE FILTERS AGAINST RADIOACTIVE AEROSOL. ON THE RADIOACTIVE CONTAMINATION AND ITS REMOVAL. Toyohiko Miura and Kikuzi Kimura (Inst. for Science and Labour, [Tokyo]). Rôdô Kagaku 35, 818-23(1959) Dec. (In Japanese)

Dust filters were examined using a radioactive solid-aerosol, decay product daughters of Rn^{220}. An examination with a thermal precipitator revealed that the major part of particles in the radioactive aerosol were smaller than 0.5 μ in diameter. Twenty-one kinds of filters were tested. The filtering efficiency was highest in asbestos fiber filters. A radioautographic examination revealed that the radioactive substance penetrated as deep as 1.4 to 1.5 mm into the filter layer. (auth)

Raw Materials and Feed Materials

8494 AERE-X/M-170

Impregnated Diamond Products Ltd., Gloucester, England. AN ANALYTICAL CONTROL FOR THE THORIUM OXIDE-CHLORIDE CONVERSION PROCESS. J. R. Chalkley. Dec. 1956. 12p.

Two analytical methods were used for establishing the end point of the conversion of thorium oxide to chloride in a molten chloride bath. Both trace the change in chlorine content of the bath as the conversion proceeds, the end point being given by the constancy of successive results. (auth)

8495 CEA-1084

France. Commissariat à l'Énergie Atomique, Paris. TRAITEMENT THERMIQUE DES SCHISTES URANIFERES. (Heat Treatment of Uranium-bearing Shale). P. Michel. Mar. 1959. 15p.

In view of the difficulties encountered in rendering soluble the uranium content of shales worked in the Vosges region, and in their filtration after attack, the effects of heat treatment at high temperatures (300 to 600°C) on these two factors is discussed. The first part deals with tests in static beds, the second in fluid beds. In both cases calory recovery is discussed. The treatment improves filtration but not solubility. (auth)

8496 CEA-1085

France. Commissariat à l'Énergie Atomique, Paris. ETUDE DES TRAITEMENTS DE MINERAIS D'URANIUM PAR VOIE SECHE. (Study of the Dry Processing of Uranium Ores). H. Guillet. Feb. 1959. 13p.

A description is given of direct fluorination of preconcentrated uranium ores in order to obtain the hexafluoride. After normal sulfuric acid treatment of the ore to eliminate silica, the uranium is precipitated by lime to obtain either impure calcium uranate of medium grade, or containing around 10% of uranium. This concentrate is dried in an inert atmosphere and then treated with a current of elementary fluorine. The uranium hexafluoride formed is condensed at the outlet of the reaction vessel and may be used either for reduction to tetrafluoride and the subsequent manufacture of uranium metal or as the initial product in a diffusion plant. (auth)

8497 CEA-1086

France. Commissariat à l'Énergie Atomique, Paris. RECUPERATION DE L'URANIUM DES LIQUEURS

D'ATTAQUE DES SCHISTES PAR ECHANGE D'IONS. (Recovery of Uranium from Liquors from Shale Attack by Ion Exchange). B. Parly and P. Pottier. Apr. 1959. 23p.

The recovery is described of the uranium from shale mined at Schaentzel with a U content of 285 ppm. Recovery is by alkaline attack with a solution of 25 g/l Na_2CO_3 at 75°C followed by absorption of the dissolved uranium by an anionic Amberlite resin, IRA 410. Final recovery is by elution with a solution of M $NaNO_3$. These treatment tests determine the capacity of the resin in the case of the above solutions, verify the effects of recycling on this capacity, and finally, provide figures on the consumption of reactive and efficiency of attack and uranium recovery. (auth)

8498 CEA-1088

France. Commissariat à l'Énergie Atomique, Paris.

LE PROCEDE "RESIN IN PULP" ET SON APPLICATION AUX MINERAIS DES BROSSES "BRS 10." (The Resin-in-pulp Process and Its Application to Ores from Brosses "BRS 10"). M. Kremer. Mar. 1959. 30p.

The resin-in-pulp process is a technical variant of the recovery process of uranium in dilute solution by means of ion exchange resins. An anion resin, XE 123, of a well-defined grain size is placed in direct contact with the pulp produced by sulfuric acid attack on ore with a low uranium content. This process is of particular value in the treatment of pulps that cannot be filtered or decanted, such as those obtained with ore from Brosses. The preparation of the pulp, the elution of the uranium, and its fixation, as well as the various factors encountered in these operations, are discussed. (auth)

8499 CEA-1089

France. Commissariat à l'Énergie Atomique, Paris.

ÉTUDE POUR LE TRAITEMENT DU MINERAI DU FOREZ. (Processing Ore from Forez). M. Kremer. Dec. 1957. 45p.

A new process is given for the chemical separation, simply and economically, of the uranium contained in solutions formed by sulfuric acid attack of low uranium content ores. The attacking solution is processed in two stages. The solution is neutralized to pH 2.7 to 3 with milk of lime and a portion of the dissolved impurities are precipitated. Then milk of lime of the uranium is precipitated at to pH 6.5 to 7. The uranium concentrate is then subjected to controlled sulfuric attack for its total reduction to a solution containing a minimum of foreign ions. The uranium solution thus obtained is purified by extraction with TBP. (auth)

8500 MCW-152

Mallinckrodt Chemical Works, St. Louis.

PROGRESS REPORT OF PILOT PLANT WORK ON UF_4 PRODUCTION BY CONTINUOUS METHODS. Period [covered] August 15, 1948 to October 21, 1948. E. K. Teter. Oct. 15, 1948. Decl. Oct. 7, 1959. 12p. OTS.

Production of UF_4 from brown oxide is reported. Normal metal yields were obtained from the green salt and the quality of the metal was satisfactory except for high boron and iron content. Data on the runs are included. (For preceding period see MCW-109.) (J.R.D.)

8501 MCW-1442

Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.

PROCESS DEVELOPMENT QUARTERLY REPORT [FOR] OCTOBER–DECEMBER 1959. Feb. 1, 1960. 98p. Contract W-14-108-Eng-8. OTS.

The investigation of practical means to ignite ore concentrate samples to constant weight and of their stability following the ignition is reported. Domestic ore concentrates have been classified according to the temperature necessary, and the preliminary data indicate that the resulting ignited material is quite stable with respect to atmospheric moisture and/or carbon dioxide. An outline of a simplified procedure is presented for the assay of uranium ore concentrates. Methods of eliminating possible interferences and further data concerning interference studies are included. No significant interferences were detected at levels of impurities normally found in the concentrates. The chief cause of emulsions in the Weldon Spring refinery identified so far has been the solids in the feed liquors. A wetting agent, Nalcamine, has shown promise as a means of controlling these emulsions in many (but not all) feed liquors. Laboratory investigations with synthetic and refinery liquors indicate that a decontamination factor for antimony of the order of 3700 can be expected in the Weldon Spring refinery. The molybdenum contamination of refinery product has been found to result from both entrainment of aqueous phase in the plant extracts and from extraction of molybdenum into the solvent. The quantity of molybdenum extracted depends partially upon the presence of impurities in the plant solvent. "Extracted" molybdenum can be removed from the solvent by saturation with uranium or by an efficient sodium carbonate scrub. The compound responsible for uranium retention in the Weldon Spring plant solvent has been identified as bis-(2-ethylhexyl) phosphoric acid that is introduced into the plant via ore concentrates, the plant feed material. Laboratory investigation demonstrated the basic feasibility of an anion exchange process for the removal of uranium from spent sodium carbonate solvent-treatment liquor. The extent of organic-fouling of the resin after long use was not determined. The fluid-bed denitrator demonstrated reproducible operation over an extended period. The effects of fluidizing medium and sulfate level on equipment performance and product character were also studied. The pilot-plant fluid-bed reduction reactor was successfully operated, producing high-assay UO_2 product from "as-is," fluid-bed UO_3. Productivity and solids mixing characteristics were also studied. Scoping attempts to produce uranium hexafluoride by an electrolytic mechanism in a fused fluoride system were unsuccessful. Fluidized-bed outgassing of UF_4 with hot, dry air, explored as a possible means of controlling hydrogen in uranium, is shown in a laboratory evaluation to be an effective means of removing moisture without reversion to UO_2. (auth)

8502 NP-8360

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

PREPARATION OF URANYL SULPHATE FROM URANIC OXIDE. Report No. 118/IV. T. S. Urbański. Nov. 1959. 3p.

The preparation of uranyl sulfate from UO_3 is described. The method is based on the precipitation of acetone-uranyl sulfate complex. A stoichiometric proportion U : SO_4^{2+} product is obtained. (auth)

8503

USE OF MOVING BED ION EXCHANGE IN THE RECOVERY OF URANIUM AT CAN-MET EXPLORATIONS, LTD., BLIND RIVER, ONTARIO. P. D. R. Maltby (Can-Met Explorations, Ltd., Blind River, Ont.). Bull. Inst. Mining & Met. 69, 95-109(1959) Dec.

Uranyl sulfate, obtained by leaching uranium ores of the order of 0.10% uranium with sulfuric acid, is adsorbed on moving bed ion exchange resins as an anionic complex. Most of the impurities in the leach solutions are not adsorbed. The uranium content of the resulting eluate is increased by a factor of 30 to 40 from the pregnant solutions. The eluate is precipitated in two stages, an iron-

gypsum precipitate being returned to the leaching circuit from the first stage, and the uranium product which is produced in the second stage. (auth)

Separation Processes

8504 BM-RI-5570
Bureau of Mines.
LIQUID-LIQUID EXTRACTION OF RARE-EARTH ELEMENTS. D. J. Bauer, A. C. Rice, and J. S. Berber. 1960. 13p.

Liquid-liquid extraction techniques were investigated for use in fractionation of rare-earth solutions. Laboratory extractions using TBP for ceric nitrate resulted in almost complete extraction. Tests with primary amines were also promising. In scale-up extractions of the ceric nitrate procedure 84% efficiency was obtained. (J.R.D.)

8505 CF-55-5-156(Rev. 5)
Oak Ridge National Lab., Tenn.
HRT PROCESS FLOWSHEETS—REVISED EDITION. Roy C. Robertson and J. E. Jones. Dec. 15, 1959. 18p. OTS.

Revised HRT flowsheets are presented. These revisions cover such items as relocation of freezer units on the lines, corrections to the numbering of lines, valves or instruments, and the addition of a few lines in the service areas. The waste and vent system flowsheet was redrawn as two sheets. (C.J.G.)

8506 DEGR-18(W)
United Kingdom Atomic Energy Authority. Development and Engineering Group, Windscale, Cumb., England.
THE RECOVERY OF PROTACTINIUM 231 AND URANIUM FROM SPRINGFIELDS ETHEREAL SLUDGE. PART I. PROCESS DEVELOPMENT. D. A. Collins, J. J. Hillary, and G. M. Phillips. Aug. 20, 1959. 38p.

The initiation and development of a process for recovery of Pa^{231} and U from Springfields ethereal sludge are described. In laboratory tests 98 to 99% of the U and 65 to 70% of the Pa were recovered from the sludge using this process. (J.R.D.)

8507 DP-389
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
A SURVEY OF ORGANIC SOLVENTS FOR THE ELECTRODEPOSITION OF PLUTONIUM. John A. Porter. July 1959. 12p. Contract AT(07-2)-1. OTS.

The solubility and conductivity of cerium(III) salts (as stand-ins for plutonium(III) salts) in dimethylsulfoxide, acetonitrile, ethylenediamine, and dimethylformamide were investigated to evaluate these systems as possible electroplating baths. The system dimethylsulfoxide–cerium chloride is the most promising for electrodeposition of cerium at a mercury cathode. (auth)

8508 MCW-1441
Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.
DEVELOPMENT OF THE TBP-HEXANE PROCESS FOR URANIUM PURIFICATION. W. C. Philoon, R. M. Edwards, and R. H. Farris. Feb. 1, 1960. 16p. Contract W-14-108-eng-8. OTS.

The development of the TBP–hexane process for the Weldon Spring Plant is described. (W.L.H.)

8509 NYO-7569
Boston Univ.
SEPARATION OF URANIUM FROM BISMUTH USING TRIS(2-ETHYLHEXYL)PHOSPHINE OXIDE. INCREASE IN SELECTIVITY WITH 1,2-CYCLOHEXYLENE DINITRILO TETRAACETIC ACID. Work completed: September 1958. Arno H. A. Heyn and Gurupada Banerjee. Nov. 24, 1959. 15p. Contract AT(30-1)-1873. OTS.

Experiments designed to find a quick and straightforward method for the separation of trace amounts of uranium from large excess of bismuth, allowing for a subsequent determination of the former, are described. It has been shown that the possibility of such separations using tris(2-ethylhexyl)phosphine oxide can be enhanced if another masking agent is introduced into the system. Extraction with tris(2-ethylhexyl)phosphine oxide in the presence of 1,2-cyclohexylene dinitrilotetraacetic acid followed by ultraviolet absorption has been successfully utilized to develop a method for the separation of uranium from 20,000-fold excess of bismuth. (auth)

8510
EXTRACTION OF THORIUM WITH THENOYLTRIFLUROACETONE. EFFECT OF ACETIC ACID. Gerald Goldstein, Oscar Menis, and D. L. Manning (Oak Ridge National Lab., Tenn.). Anal. Chem. 32, 400-4(1960) Mar.

The effect of acetic acid on the extraction of thorium with thenoyltrifluoroacetone in carbon tetrachloride and in hexone was studied. To account for the enhanced extraction of thorium in the presence of acetic acid, reactions are proposed which involve the formation of thorium-thenoyltrifluoroacetone-acetic acid addition compounds and a thorium-acetate complex. Approximate equilibrium constants for the proposed reactions were calculated. The selection of the organic solvent will depend upon its effect on several factors which influence the distribution of thorium. Among these are the miscibility of the phases, the solubility of the metal chelate in the organic phase, and the distribution of acetic acid and thenoyltrifluoroacetone between the organic and aqueous phases. (auth)

8511
ATOMIC FUEL PROCESSING. PART IV. SAVANNAH RIVER DOES IT CHEAPER. Chem. Eng. 67, No. 4, 135-8 (1960) Feb. 22.

Three fuels are to be processed at Savannah River: the Enrico Fermi breeder power reactor (PRDC) and the NRX and NRU reactors at Chalk River. Methods which are used in the processing of the fuels are presented in order of shipment from the reactor to the solvent extraction of plutonium from the uranium solution. The processing of two PRDC cores yield about 100,000 gal of waste, which will be stored until fission products decay sufficiently for concentration to about 35,000 gal and final storage. (B.O.G.)

8512
PROCESS OF RECOVERING URANIUM VALUES. (to Union Carbide Corp.). British Patent 824,413. Dec. 2, 1959.

A process is described for recovery of U from alkali metals, alkaline earths, transition elements, and rare earths. The U-containing material is hydrided and then reacted with alkali metal acid fluoride. The resulting mixture is then treated with HF. Then, treatment with F_2 gas causes UF_6 to volatilize and be separated. (T.R.H.)

8513
PROCESS FOR THE PURIFICATION OF PLUTONIUM SOLUTIONS. (to United Kingdom Atomic Energy Authority). British Patent 826,910. Jan. 27, 1960.

A process is presented whereby Pu solutions are purified by adsorption of $Zr_3(PO_4)_4$, $BaIO_3$, or zeolite, followed by elution. In the example given, the Pu solution was passed at 33 ml/min through 4 g of $Zr_3(PO_4)_4$. The de-

sorbing solution to remove fission products was 3.3 l of 0.1 M H_3PO_4 and 2 M HNO_3. The Pu was removed in 5.8 l of 7 M HNO_3. (T.R.H.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

8514 AECU-4688

Franklin Inst. Labs. for Research and Development, Philadelphia.

REFINEMENTS OF THE THEORY OF THE INFINITELY-LONG, SELF-ACTING, GAS-LUBRICATED JOURNAL BEARING. Interim Report. Harold G. Elrod, Jr. and Albert Burgdorfer. Jan. 1960. 48p. Sponsored by DOD; AEC; Maritime Administration; and NASA under Contract Nonr-2342(00). (I-A2049-10). OTS.

The lubrication equations for an arbitrary Newtonian fluid are derived directly from the general equations for conservation of mass, momentum, and energy. From the lubrication equations an inequality is obtained for the internal film temperature rise, after which the isothermal film equations are derived. Then, for perfectly-aligned self-acting journal bearings, a conservation equation is obtained. For gas bearings this condition gives: $\int_0^{2\pi} P^2 h^3 d\Theta =$ constant along the axis of the bearing. Application of this condition to the infinitely-long gas bearing gives more accurate pressure solutions for this case. The Katto-Soda form of the differential equation for the infinitely-long bearing is solved by a series expansion in the eccentricity ratio, the first terms of which give the original, approximate Katto-Soda solution. In addition, solutions obtained numerically by digital computations are presented in graphical and tabular form for eccentricity ratios from $0 \rightarrow 0.9$ and compressible bearing parameter, λ_1 from $0 \rightarrow \infty$. Design charts based on these calculations are provided. (auth)

8515 CF-60-1-17

Oak Ridge National Lab., Tenn.

SUPPLEMENTARY REPORT NO. 1 [ON VACUUM SYSTEMS]. C. E. Normand. Jan. 6, 1960. 22p. OTS.

An investigation of various vacuum problems, such as erroneous ionization gages, effect of dome size on measured pump speed, effect of leak beaming on measured pumping speed, and effects of fractionation on ultimate pressure, is presented. (W.L.H.)

8516 NYO-2897

Westinghouse Electric Corp. Research Labs., Pittsburgh.

ULTRAHIGH VACUUM TECHNIQUES. Quarterly Progress Report [for] October 1–December 31, 1959. Research Report 403FF466-R5. Jan. 22, 1960. 12p. Contract AT(30-1)-2176. OTS.

Limited effort on component development continued. The isolation characteristics of zeolite pellets for use in non-refrigerated traps are being studied. Research on the photomultiplier ion gage extended the operating range to 10^{-9} mm Hg. Fundamental studies on bombardment of surfaces were continued. Preliminary results indicate that rare gas ions driven into metal surfaces cannot be recovered completely by heating the metal to 1200°C. (For preceding period see NYO-2896.) (J.R.D.)

8517 ORNL-2814

Oak Ridge National Lab., Tenn.

MAXIMUM VOLUME-TO-STRESS RATIO FOR A TWO-RADII-CONTOUR DIAPHRAGM PUMP. R. D. Cheverton. Feb. 15, 1960. 16p. Contract W-7405-eng-26. OTS.

Analytical methods were employed to determine the maximum volume-to-stress ratio for a two-radii-contour diaphragm pump. A proposed failure criterion considers the effect of biaxial stresses on fatigue failure through the use of the Mises-Hencky criterion for fatigue failure. By use of the proposed criterion, it was determined that an optimum ratio of the two radii does exist, its value being dependent on the ratio of diaphragm thickness to diaphragm deflection. Values for the optimum ratio of the two radii (where the ratio of radii is defined as the radius of the central portion of the diaphragm contour divided by the radius of the outer portion of the diaphragm) range from 1.94 to 7.33 as the ratio of diaphragm thickness to diaphragm deflection varies from 0.5 to 0.05, respectively. (auth)

8518 R-341(RAND)(Vols. I and II)

RAND Corp., Santa Monica, Calif.

PROCEEDINGS OF THE SECOND PROTECTIVE CONSTRUCTION SYMPOSIUM (DEEP UNDERGROUND CONSTRUCTION), MARCH 24-26, 1959. J. J. O'Sullivan, comp. (Vol. I, 510p.; Vol. II, 488p.).

These two volumes were issued separately, but are cataloged as a unit.

Forty-five papers are included in this symposium. The subjects covered by these papers include: problems of the underground area, site selection for deep underground installations, design of exposed items, utilities for deep underground installations, new construction methods and equipment, underground construction experience, and nuclear burst. (W.L.H.)

8519 TID-4100(1st Rev., Suppl. 6)

Technical Information Service Extension, AEC.

ENGINEERING MATERIALS LIST. Richard E. C. Duthie and Francis L. Sachs, eds. Jan. 1960. 25p.

Engineering materials lists are presented which cover valves, hot-lab equipment, chemical and radiation instruments, reactors and reactor facilities, plant process and radiation equipment, and shielded containers. (C.J.G.)

8520 IGIS-26(RD/R)

THE DESIGN OF PUMP COMBINATIONS WITH ROOTS PUMPS. K. Ziock. Translated by M. F. Sheppard from Vakuum-Tech. 6, 98-101(1957). 8p.

The pumping speed and performance of a vacuum Roots pump are calculated. The combinations of water jet and rotary oil pumps as backing pumps for Roots pumps are discussed. (C.J.G.)

8521

MATERIALS FOR ISOTOPE LABORATORIES. L. Von Erichsen (Universität, Bonn). Atomwirtschaft 2, 72-4 (1960) Feb. (In German)

Isotope laboratories are more fastidious than conventional chemical laboratories with respect to the choice of suitable working materials. There are, however, materials with outstanding properties available. Numerous materials such as wood, steel, tiles, plastics (PVC, polyethylene, polypropylene, PTFE) and many others are compared with respect to their existing properties as construction materials; in particular with respect to important properties such as ease of working and shaping, corrosion resistance against acids and alkalies, solvent resistance, surface finish, heat resistance, ease of renovation, adhesive bonding, and price. (auth)

8522

EXPERIENCE IN DESIGNING, BUILDING, AND OPERATING INDUSTRIAL RADIOISOTOPE APPLICATORS. József Hirling (Radioisotope Lab. of the Csepel Iron and Steel Works, Central Material Testing Station, [Budapest]). Energia és Atomtech. 12, 18-21(1959) Jan. (In Hungarian)

Descriptions are given of five types of industrial irradiation facilities. Four are lead spheres, mounted on ball bearings at their horizontal axes, around which they can be rotated with the aid of worm gears and remote-control rods. The four differ in lid design and in the manner in which the isotope capsules are mounted. The fifth applicator has a radiating chamber. A Bowden cable brings the isotope capsule into the radiation chamber by remote control. (JPRS)

8523

DOUNREAY "HOT" LABORATORY. D. W. Collins and J. W. Woods (Pye, Ltd., Cambridge, Eng.). Nuclear Eng. 5, 75-6(1960) Feb.

The "hot" laboratory at Dounreay for handling highly radioactive specimens remotely and safely is described. The installation makes possible a completely remote metallurgical investigation of fuel specimens from fuel element disassembly to disposal of waste. (B.O.G.)

8524

METHOD FOR TESTING COATINGS. (to United Kingdom Atomic Energy Authority). British Patent 826,121. Dec. 31, 1959.

A method is described for testing coatings for tiny holes. It is applicable to metal claddings on uranium. The coating to be tested is exposed to H_2 at 200 to 300°C. Holes which allow the H_2 to react with the U are made obvious by black or brownish-black reaction product deposits. (T.R.H.)

8525

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF GRINDING SURFACES. Alan Blainey (to United Kingdom Atomic Energy Authority). British Patent 826,938. Jan. 27, 1960.

An abrasive surface is formed on a metal by fixing Zr or Ti particles to it at 900°C. In an example, stainless steel or Ni is cleaned by abrasion and washed with xylene and dried. A 0.005-in. layer of Zr powder of 2 to 20 μ particles in xylene is deposited and dried at 100°C. The piece is then heated to 1000°C for 10 or 15 minutes and cooled. Finally, Zr powder (20 to 200 μ) in xylene is sprayed on, dried, and heated slowly in vacuum to 930 to 1100°C and allowed to cool in vacuo. (T.R.H.)

8526

IMPROVEMENTS IN OR RELATING TO SHAFT SEALS. Terence Barrett, Douglas English, and Kenneth John Williams (United Kingdom Atomic Energy Authority). British Patent 827,015. Jan. 27, 1960.

A shaft seal of the viscosity-groove type is offered. Grooves are arranged in one of two drive plates so that rotation of one of the plates causes oil in the grooves to be compressed against the gas pressure being sealed. When not rotating, a spring forces the plates together at ungrooved surfaces to provide a seal. (T.R.H.)

8527

IMPROVEMENTS IN OR RELATING TO ADAPTORS FOR USE IN PASSING STAINLESS STEEL PIPES INTO MILD STEEL VESSELS. William George Hutchinson and Jack Jones Griffiths (United Kingdom Atomic Energy Authority). British Patent 827,315. Feb. 3, 1960.

An adaptor for connecting stainless steel pipe to mild steel vessels is described which provides for easier weldings, weld stress relief, and weld inspection. The pipe is provided with a stainless steel skirt which has a mild steel extension welded on. This mild steel extension may be welded directly to mild steel plate of the vessel or to a mild steel sleeve previously welded to the vessel and heat treated. (T.R.H.)

8528

IMPROVEMENTS IN OR RELATING TO SEALING DEVICES. James Carrie Guild (United Kingdom Atomic Energy Authority). British Patent 827,321. Feb. 3, 1960.

A liquid-dip sealing device is offered in which the liquid seal is restored after being ejected by a pressure surge. The liquid on one side of the seal is lowered by the excessive pressure until an opening is exposed which allows gas pressure to escape until the pressure loss allows the liquid to rise again. (T.R.H.)

8529

IMPROVEMENTS IN OR RELATING TO ELECTRIC PUMPS. David Melvyn Harris and Edward Holland (to United Kingdom Atomic Energy Authority). British Patent 827,784. Feb. 10, 1960.

A glandless electric pump for electrically insulating liquids is described. The liquid is allowed to come in contact with stator windings. (T.R.H.)

8530

IMPROVEMENTS IN OR RELATING TO SHELF UNITS FOR RACK-MOUNTED ELECTRICAL EQUIPMENT. Charles William Darlington and Arthur Stirling (to United Kingdom Atomic Energy Authority). British Patent 828,275. Feb. 17, 1960.

A shelf unit for rack-mounting sub-standard size electrical components in standard racks is described. Provision for proper ventilation is also made. (T.R.H.)

Heat Transfer and Fluid Flow

8531 AD-206971

Virginia. Univ., Charlottesville. Ordnance Research Lab. LABORATORY INVESTIGATION OF THE BASIC NATURE OF LOW DENSITY GAS FLOW AT HIGH SPEEDS. Quarterly Progress Report for the Period July 15, 1958–October 15, 1958. A. R. Kuhlthau and J. H. Bodine. 24p. Contract NOrd-18211. (UVA/ORL-18211-58-QPR-2).

A research program is discussed which utilizes high rotational speed techniques to study drag phenomena at low densities. Results have been obtained over a pressure range from 10^{-4} to 10^{-3} mm Hg and over a surface speed range corresponding to Mach numbers from 0.47 to 1.5 in air at room temperature. Observations of the surface molecular reflection parameter were made by molecular beam scattering. Rotating cylinder experiments are described which were directed toward specific areas which might cast reflections on the basic nature of the interaction of gas molecules and solid surfaces. Experiments are also described in which surface contamination and the influence of gas content are carefully controlled. (W.D.M.)

8532 KAPL-RDTR-310(Pt. II)

Knolls Atomic Power Lab., Schenectady, N. Y. HEAT TRANSFER FOR 7¼"-PITCH RIBBONS AT LOW FLOWS. C. L. Gregory. [Jan. 1960]. 96p. OTS.

A program to measure heat transfer rates for 7¼ in. pitch ribbons at low flows to provide data for use in evaluating the performance of an emergency cooling system is described. Data are presented from a test sequence conducted at 2200 psia, a flow of 112,000 lb/hr-sq ft, a flux of 15,000 to 100,000 Btu/hr-sq ft, and nominal exit conditions varying from 30°F subcooled to 70% quality. A description of the experimental procedure and an analysis of results are included. (J.R.D.)

8533 NGTE-M-328

Gt. Brit. National Gas Turbine Establishment, Farnborough, Hants, England.

THE CALCULATION OF GAS FLOW PASSAGE SIZES IN HEAT EXCHANGERS AND NUCLEAR REACTORS WHEN THE HEAT TRANSFER REQUIREMENTS AND THE GAS INLET AND OUTLET TEMPERATURES ARE SPECIFIED. J. F. Barnes. Aug. 1959. 41p.

An approximate treatment for the determination of heat exchanger scantlings is presented. A simplified model of a gas cooled reactor core to which this analysis can be applied is defined. Modifications are introduced to allow for sources of pressure loss other than skin friction and heat addition and to take account of features peculiar to reactors, e.g., non-uniformity of heat release within the core. The calculation of pressure losses due to friction and heat addition is considered and a description is given of a step-by-step method for solving the basic differential equation for one-dimensional flow in a constant area passage. Graphs of pressure loss are presented for air (or nitrogen) and methods are suggested for using these to estimate the detailed heat transfer performance of a reactor. (auth)

8534 NP-8336

Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

THE AXIAL-FLOW COMPRESSOR IN THE FREE-MOLECULE RANGE. Charles H. Kruger. Jan. 1960. 96p. Project No. DSR 7-8120. Contract Nonr-1841(55).

The performance of an axial-flow compressor with flat-plate blades in the free-molecule range is analyzed theoretically and experimentally. It is shown that the density difference across the compressor, which results from the fraction of those molecules incident upon the blades which is transmitted through the compressor, is greater for molecules incident from the low-density side than from the high-density side. Theoretical calculations are made for both single and multiple blade rows, using the Monte Carlo method. Results indicate that density ratios per blade row are significantly greater in the free-molecule range than at aerodynamic conditions. The density ratio is found to increase with increasing blade speed and decreasing blade angle and to decrease linearly with the upstream volume flow rate. Multiple-blade-row calculations show that single-row results may be directly combined with reasonable accuracy. Density measurements across a single rotating blade row give density ratios as high as sixteen to one and show good agreement with the theoretical results. The density ratio is found to decrease markedly with increasing density level in the transition from the free-molecule range. Suggestions are made regarding the design of an axial-flow rarefied-gas compressors. A comparison of such a compressor with the commonly employed oil diffusion pumps shows several favorable aspects. The Monte Carlo method is shown to be a useful tool for the solution of problems involving the dynamics of rarefied gases. (auth)

8535 NYO-7744

New York Univ., New York.

FLOW EQUATIONS FOR A CONDUCTING IONIC LIQUID. Technical Progress Report. Benson Ross Sundheim. Jan. 25, 1960. 32p. Contract AT(30-1)-1938. OTS.

An analysis of the hydrodynamic equations of motion in fused salt systems is presented. The molecular basis for the transference number phenomenon is also considered. Applications of the theory are included. (J.R.D.)

8536 AEC-tr-3977

INVESTIGATIONS OF FRICTIONAL PRESSURE LOSSES IN STEAM AND WATER MIXTURES AND LEAD VELOCITY OF STEAM IN VERTICAL BOILER TUBES. K. Jaroshek and F. Brandt. Translated by Lydia Venters (Argonne National Lab.) from Brennstoff-Wärme-Kraft 11, 407-13 (1959). 21p. JCL.

The values known at present on lead velocities of steam and friction coefficients were supplemented by means of measurements in a vertically flowing steam-and-water mixture in a water circulation model of a natural size up to the pressure of 200 atm abs for a tube of 57.5 mm in inside diameter. Theoretical interpretation of the data allowed one to analyze the lead velocity as a true constituent determined by the square profile density. The increase in the friction coefficients could be explained by an increased degree of turbulence of the mixture flow. The measurements on a 42.0 mm tube light diameter lead one to conclude that there is a substantial effect of the diameter, but it has to be tested in the future. (auth)

8537

THE BASIC HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS OF SIX COMPACT HIGH-PERFORMANCE HEAT TRANSFER SURFACES. W. M. Kays (Stanford Univ., Calif.). J. Eng. Power 82, 27-34 (1960) Jan.

The basic heat transfer and flow friction characteristics of six new compact high-performance surfaces are presented. Four are of the strip-fin type, including three stacked in a unique multiple sandwich arrangement. One of the surfaces has perforated fins formed by punching circular holes through the fins, and one has wavy fins. The basic characteristics are presented in terms of $N_{St}N_{Pr}^{\frac{2}{3}}$ and f versus Reynolds number. A sufficient geometrical description is provided so that the data are readily usable in heat exchanger design analysis. A general solution for determining fin effectiveness of any double or triple sandwich arrangement is presented. (auth)

Instrumentation

8538 AD-214677

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

DESIGN OF A TRIPLE-COINCIDENCE-GATED SUMMING CIRCUIT (thesis). Daniel Blaine Harris. Mar. 1959. 86p.

Design logic is established. Generalized Laplace transfer functions are derived for high-frequency transistors using hybrid-parameters. Requirements of linear pulse amplifiers are determined. Capabilities of 2N384 are investigated. A passive summing network is proposed. Attenuation and coupling are investigated. Saturated transistor series and gate is analyzed as coincidence circuit. A monostable multivibrator is designed as gate control circuit. Fast diode shunt-gate is proposed. Circuit design is integrated. Capabilities of passive peak summing with transistor follow-up and of a diode shunt-gate are experimentally demonstrated. (auth)

8539 AD-225605

Westinghouse Electric Corp. Research Labs., Pittsburgh.

FIVE KILOWATT THERMOELECTRIC GENERATOR. Bimonthly Progress Letter No. 1. May 12, 1959. 52p. Contract Nobs 77093.

Design of thermoelectric material configurations and environmental checking of thermoelectric elements are described. Life data on Bi–Te and ZnSb were obtained at

400°C to 1000 hrs. Tests on other materials are beginning. A Datatron computer program was constructed to calculate sandwich element geometries for various generator conditions. (auth)

8540 AECU-4634

General Electric Co. Specialty Electronic Components Dept., Auburn, N. Y.

HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 4 [for] August 19, 1957–December 31, 1957. D. A. Lupfer. 73p. Contract AT(30-1)-1963. OTS. (For preceding period see AECU-3552.)

8541 AECU-4635

General Electric Co. Specialty Electronic Components Dept., Auburn, N. Y.

HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 5 [for] January 1, 1958–March 31, 1958. D. A. Lupfer. 72p. Contract AT(30-1)-1963. OTS.

8542 AECU-4636

General Electric Co. Missile and Space Vehicle Dept., Philadelphia.

HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 6 [for] April 1, 1958–June 30, 1958. D. A. Lupfer. 50p. Contract AT(30-1)-1963. OTS.

The objective of the program is the development of ceramic materials with high dielectric constant and high dielectric strength values, and suitable for use as dielectrics in capacitors capable of storing large amounts of energy in small volumes. Upon the successful development of materials and processing techniques, twenty encapsulated capacitors will be produced and delivered to the contractor. Developments in materials and sample preparation, ceramic properties and forming, fabrication of large ceramics, electrical measurements, optical studies of titanates, ceramic density measurements, and capacitor measurements and design are given. (For subsequent report in this series see AECU-4165.) (W.D.M.)

8543 CREL-779

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRANSISTORIZED COUNTING SYSTEMS. 13. A TRANSISTOR MAGNETIC CORE BUFFER STORE USED AS A DE-RANDOMIZER. T. K. Alexander, H. G. Reddering, and J. M. Kennedy. Nov. 1959. 47p. (AECL-926). AECL.

A de-randomizer was designed to reduce counting losses when recording randomly occurring codes on magnetic tape. This instrument is a buffer store with logical addressing circuits arranged to enable the store to accept events at random times and to read out these events at regular intervals. The tape is used to capacity and the counting losses are kept to a small value. The device uses type S4 ferrite cores in a 16 by 5 array, so that 16 bit codes may be de-randomized. The minimum acceptable interval between successive incoming codes is 6 μs, this interval being controlled from an external train of timing pulses. The transfer time at the code inputs is 3 μs. The de-randomizer finds application in neutron time-of-flight analysis and pulsed source counting where it becomes necessary to record more than one event per burst. (auth)

8544 CRGP-871

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

I.G.Y. EQUIPMENT AT DEEP RIVER COSMIC RAY STATION B211. J. F. Steljes and H. Carmichael. Dec. 1959. 26p. (AECL-939). AECL.

A description of the station and apparatus used in the IGY program is given. (W.L.H.)

8545 CWLSP-3-7

Chemical Warfare Labs., Army Chemical Center, Md.

DESCRIPTION AND OPERATION OF CHEMICAL CORPS HELICOPTER-TO-GROUND AERIAL SURVEY INSTRUMENT. Michael J. Schumchyk, John P. Johnson, and John R. Lapic. Dec. 23, 1958. 27p.

A helicopter-to-ground aerial radiological survey instrument and its operation are described. The instrument consists of a radiation detector mounted in a tripod connected by a four-conductor cable to an indicating meter through a powered reel. While the helicopter hovers several hundred feet in the air, the radiation detector can be positioned 3 ft above the ground. Preflight, inflight, and survey operation procedures are given. Calibration procedures for the apparatus are given. (auth)

8546 DP-426

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

WATER WHEEL RIVER AND STREAM SAMPLER. Kevin J. Travers. Nov. 1959. 11p. Contract AT(07-2)-1. OTS.

Methods of collecting water samples from flowing streams for radiation control at the Savannah River Plant are discussed. A water wheel type of proportional sampler is described. (auth)

8547 HW-61194

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STACK EFFLUENT MONITOR OPERATION AND MAINTENANCE. R. A. Harvey and G. D. Crouch. July 21, 1959. 29p.

The operation, calibration, and maintenance procedures for an instrument which continuously measures and records several isotopes in the Redox facility stack effluent are presented. (C.J.G.)

8548 IGR-189(RD/W)

United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.

THE WINDSCALE BOMB CALORIMETER. G. F. Jackson and D. Cordall. May 13, 1959. 35p. BIS.

The modifications to a standard, commercial-type, isothermal jacket calorimeter for use in measuring the total stored energy in irradiated graphite are described. The heat of combustion of unirradiated graphite was determined to be 7837.2 cal/g, indicating a standard error of ± 0.66 cal/g and an accuracy (98% confidence limits) of ± 4 cal/g in the measurement of stored energy. An assessment of the maximum error involved in the measurements is given. (C.J.G.)

8549 MND-R-1965

Martin Co. Nuclear Div., Baltimore.

RESEARCH AND DEVELOPMENT OF RADIOISOTOPE HEATER. Quarterly Progress Report No. 1 [for] March 16 to July 15, 1959. 43p. Contract AF33(616)-6325. (AD-220759).

The program objective is to replace the conventional electrical heater filament in an electron tube with a radioisotope heater. The primary problem is to confine and direct the heat from a small heat source to the cathode to effect electron emission. Polished reflectors appear as the most feasible method of heat confinement. A temperature control is considered necessary during the half life of the radioisotope. Experiments have proved the feasibility of the program. A demonstration with Po^{210} as the radioactive heat source is planned. (auth)

8550 NP-8353

Stanford Research Inst. Poulter Labs., Menlo Park, Calif.

TIME RESOLVING SPECTROGRAPH. Technical Report 017-59. G. E. Duvall and D. B. Moore. Dec. 22, 1959. 28p.

A description of a time resolving spectrograph is given and procedures used for dispersion and sensitivity calibrations are reported. The average spectral dispersion of the instrument is about 2450 A per inch and the best resolution is about 3 A. Spectra are shown from a condenser discharge across a spark gap and from detonations running into air. A procedure is described for calculating source temperature from measured film density and applied to the air shock from a Mach detonation. Results indicate the procedures and calibrations to be adequate for temperature determinations. (auth)

8551 NYO-2926

Airborne Instruments Lab. Div. of Cutler-Hammer, Inc., Deer Park, N. Y.

FINAL ENGINEERING REPORT ON AUTOMATIC SCANNING OF NUCLEAR EMULSIONS. Report No. 2644-1. K. C. Speh and S. Becker. Dec. 1959. 97p. Contract AT(30-1)-1786. OTS.

The feasibility of designing automatic instruments to scan nuclear emulsions and detect, count, or sort particle tracks according to grain density or length was studied. After investigating the characteristics of nuclear emulsions and several possible scanning techniques, an experimental model and an evaluation model of an Automatic Nuclear Emulsion Scanner, incorporating electron-beam scanning, were designed and developed to count the proton tracks in neutron film-badges. Tests at the Brookhaven Health Physics Division indicated that the evaluation model has an energy response that is similar to that of visual techniques from 2 to 15 Mev and poorer from 0.5 to 2 Mev, and a counting speed that has proved comparable with that of visual techniques at low exposures and considerably greater at exposures that exceed 1 MPE. The count of the scanner is easier to standardize and check, and is less disturbed by gamma fogging. Similar techniques are proposed for alpha-particle spectrometry, neutron spectrometry, and sorting high-energy proton-recoil tracks by grain density. (auth)

8552 UCRL-9035

California. Univ., Berkeley. Lawrence Radiation Lab.

CURRENT-SWITCHING CIRCUITRY (thesis). Jack Gilbert Salvador. Jan. 11, 1960. 33p. Contract W-7405-eng-48. OTS.

High-speed switching circuits using the basic current-switching mode of operation are discussed. A dynamic analysis of the basic current-switching mode is presented and it is shown that this mode is an overdriven amplifier in a common-emitter configuration. Therefore the dominant natural frequency, which determines the switching time, is f_β, the short-circuit cutoff frequency in the common-emitter configuration. The comparison of switching-time estimates and experimental measurements, considering only the gain-bandwidth product, often shows agreement within less than a factor of two. Reasons for this conformity are presented, and the errors introduced by considering the gain-bandwidth product alone are described. Dynamic and steady-state analysis of a current-switching flip-flop are also presented. A conventional saturated Eccles-Jordan circuit is compared analytically and experimentally with the current-switching flip-flop. Switching time, pulse pair resolution, and repetition rate describe each circuit's operation. (auth)

8553 AEC-tr-3981

PRESENT TECHNICAL POSSIBILITIES FOR RADIATION MONITORING IN GASES, USING IONIZATION CHAMBERS. H. Boehm. Translated for Los Alamos Scientific Lab. from Atompraxis 3, 369-72(1957). 7p. JCL.

The continuous monitoring of air and other gases for their content of toxic radioactive constituents in the vicinity of reactors, laboratories, and U mines and reduction plants is discussed. The design and construction of an ionization chamber for radiation monitoring are presented. (W.L.H.)

8554 CEA-tr-A-407

LE COMPTEUR DE SCINTILLATION À GAZ. (Gas Scintillation Counter). W. Hanle and K. Schmidt. Translated into French from Ann. Physik (6), 20, 173-7(1957). 9p.

The properties of a gas scintillation counter are discussed, and some measurements of dead-time of the luminescence in the gas and gas mixtures are reported. (tr-auth)

8555 SCL-T-294

ON THE IGNITION PHENOMENA OF DISCHARGE TUBES WITH AN IGNITER. Yasushichi Gosho. Translated by Noburu Hiraga (Sandia Corp.) from Denki Gakkai Zasshi 74, 271-7(1954). 33p. JCL.

Discharge tube ignition phenomena are divided into three parts: (1) occurrence of the spark, (2) breakdown between anode and cathode, and (3) maintenance of the spark. Experimental results are given on the conditions of (2) as the cathode spark was determined by utilizing an arc at the time of the igniter rod dip-in. With the igniter rod circuit conditions constant, the following results were obtained: (1) the characteristics of ignition voltage and atmospheric pressure became U-shaped and a minimum value was found to exist in the ignition voltage, V_a; (2) variation in V_a is slight for atmospheric pressure change; and (3) the discharge tube anode area produced little effect on V_a. When the discharge tube temperature was equal to room temperature, the following results were observed: (1) if the igniter rod current is small, V_a is high and if the current is increased, V_a decreases to a minimum of 25 v; (2) if the duration period of the spark is short, V_a is high and if the duration period is increased, V_a decreases to a minimum of 25 v; (3) V_a did not change through arc current variations of 50 to 550 ma; and (4) the increasing rate of the anode current at the time of ignition is controlled only by the anode voltage. In studying the inverse ignition phenomenon in a mercury rectifier, the effect of inductance in the anode circuit was found to increase V_a. In the double discharge phenomenon, the inductance generally disrupted the progress of discharge. (C.J.G.)

8556 TT-850

THE PHOTOMULTIPLIER TUBE PHOTON COUNTER. S. F. Rodionov and A. L. Osherovich. Translated by D. A. Sinclair from Doklady Akad. Nauk S.S.S.R. 74, 461-3(1950). 8p. JCL.

The construction of a photomultiplier tube photon counter is described (λ = 3600 to 6500 A) suitable for the measurement of luminous fluxes of the order of 10^{-14} to 10^{-15} lumens. (W.L.H.)

8557

A STUDY OF METHODS FOR OBTAINING HIGH RESOLUTION WITH A PAIR SPECTROMETER. G. A. Bartholomew, P. J. Campion, and K. Robinson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 38, 194-216(1960) Feb.

Methods of improving the resolution and line shape of a flat magnetic field pair spectrometer with the aid of specially designed detector apertures are described. The

performance of two such apertures is described. The theoretical line shape and resolution for one type of aperture are calculated and compared with experiment. (auth)

8558

RADIOACTIVE TRACERS FIND JET FUEL FLOW RATES. J. D. Keys and G. E. Alexander (Dept. of Mines and Technical Surveys, Ottawa). Electronics 33, No. 8, 58-9(1960) Feb. 19.

A circuit is described for determining the flow rate of jet fuel containing a radioactive tracer. Simultaneous gating of the oscillator and radiation detector permits recording of the flow rate. (C.J.G.)

8559

HIGH TEMPERATURE STRAIN GAUGES. Keith Haines. Hawker Siddeley Tech. J., No. 3, 4-8(1959).

The design and construction of a high-temperature wire strain gage for measuring turbine rotor blade vibrations are discussed. The discussion includes wire size, types of bonding cements, bonding procedure, calibration, and turbine installation. A description of the equipment used to investigate the turbine rotor blade vibrations under actual engine running conditions is given. (C.J.G.)

8560

STANDARD FREE-AIR CHAMBER FOR THE MEASUREMENT OF LOW ENERGY X-RAYS (20 TO 100 KILOVOLTS-CONSTANT-POTENTIAL). Victor H. Ritz. J. Research Natl. Bur. Standards 64C, 49-53(1960) Jan.-Mar.

A description of a "low" energy free-air chamber is given. The standard chamber is designed to measure the exposure dose in roentgens for x-ray beams generated at potentials from 20 to 100 kilovolts-constant-potential (kvcp) with filtrations ranging from 2 mm of beryllium to 2 mm of beryllium plus 4 mm of aluminum. The chamber was compared with a "medium" energy standard at 60, 75, and 100 kvcp with filtrations of 3, 3, and 4 mm of aluminum, respectively. The two standard chambers agreed to within 0.3%. (auth)

8561

CONTROL DEVICE FOR EVAPORATION OF RADIOACTIVE LIQUIDS IN COUNTING DISHES. K. Zander (Hahn-Meitner Institut für Kernforschung, Berlin). Kerntechnik 2, 28-9(1960) Jan. (In German)

A control circuit is described for regulating the evaporation of samples of slightly radioactive fluids (10^{-4} μc/ml) for counting purposes. (T.R.H.)

8562

MEASUREMENT OF SOFT β-RADIATION IN THE THICK LAYER OF A SUBSTANCE. N. A. Fedorov. Med. Radiol. 5, No. 1, 58-60(1960) Jan. (In Russian)

The described method for the measurement of soft β radiation in a substance is based on a comparison of the count rate in a thickness of the substance with an identical thickness of a standard. (C.J.G.)

8563

A CONSTANT VOLTAGE TRANSISTOR CONVERTER FOR A DKZ DOSIMETER. B. M. Abakumov. Med. Radiol. 5, No. 1, 73-4(1960) Jan. (In Russian)

A constant voltage converter is designed to substitute for two batteries in a dosimeter. The converter is a relaxation generator with a transformer connection converting direct current into alternating, the latter being then transformed to the level of 50 volts by a step-up transformer (with a switched on loading) and subsequently rectified. The dimensions of the converter are 2.7 × 3.4 × 7 cm. (auth)

8564

PROBLEMS IN AUTO-SCANNOGRAPHIC RESEARCH. I. Baschieri (Università, Rome). Minerva nucleare 3, 350-3(1959) Nov. (In Italian)

Problems of scintigraphy are discussed. The straight-bore type collimator was found to be most suitable for this research. The importance of maintaining the same distance between the crystal and the examined organ, which is situated occasionally on an asymmetrically curved surface, is discussed. A method of curved scintigraphy is described. (auth)

8565

PERFORMANCE OF A NUCLEAR EMULSION SCANNER. Paul V. C. Hough (Univ. of Michigan, Ann Arbor). Nuclear Instr. and Methods 6, 33-44(1959) Dec. (In English)

An apparatus was constructed for scanning of nuclear emulsions as used in charged particle nuclear spectroscopy. Methods developed for track detection are reviewed. An account is given of the performance of the machine in scanning plates exposed at a cyclotron over a seven month period. (auth)

8566

THE PROPORTIONAL COUNTER AS A CHARGED PARTICLE SPECTROMETER. S. Abid Husain and A. A. Jaffe (The University, Manchester, Eng.). Nuclear Instr. and Methods 6, 50-6(1959) Dec. (In English)

A proportional counter is described which is suitable as broad range charged particle spectrometer for the investigation of nuclear reaction products. Its performance was investigated experimentally and an energy resolution of 1.6% was obtained with protons of 8 Mev. The 90° proton spectrum from aluminum and magnesium oxide targets is given for deuterons of 3 and 4.1 Mev, respectively. (auth)

8567

A PULSE TO DIRECT CURRENT VOLTAGE COMPARATOR. C. H. Vincent and W. G. King (United Kingdom Atomic Energy Authority, Aldermaston, Berks, Eng.). Nuclear Instr. and Methods 6, 57-65(1959) Dec. (In English)

A simple instrument is described which enables pulse voltages to be measured very accurately by comparing them with direct current voltages. The pulses may be of the order of 1 μsec to 10 msec in duration and up to 60 v or so in amplitude, of either sign. The error in the measurement is of the order of a few parts in 10^4 for the larger voltages. (auth)

8568

A FAST NEUTRON TIME-OF-FLIGHT SPECTROMETER. Jagadish B. Garg (Univ. of Manchester, Eng.). Nuclear Instr. and Methods 6, 72-82(1959) Dec. (In English)

A time-of-flight spectrometer for the measurement of neutron energies of 0.5 to 15 Mev was constructed. The full time resolution widths of the prompt γ−γ coincidence curve from a source of Co^{60} is 6.5×10^{-10} sec. This time resolution corresponds to an energy resolution of about 1% for neutrons of 1 Mev, for a flight path of 1.5 m. The limitations on the time resolution obtained are discussed. (auth)

8569

A DIRECTIONAL SCINTILLATION COUNTER FOR NEUTRONS. R. F. Stetson and S. Berko (Univ. of Virginia, Charlottesville). Nuclear Instr. and Methods 6, 94-5(1959) Dec. (In English)

A description of several models of a directional neutron counter constructed of plastic filaments is given. Ratios as high as 1000 : 1 were obtained for the counting rate with filamental axis parallel to the neutron direction vs. the counting rate with filamental axis perpendicular to the neutron direction. (auth)

8570

ALPHA SPECTROSCOPY METHODS. S. A. Baranov and A. G. Zelenkov. Pribory i Tekh. Eksp. No. 5, 3-18(1959) Sept.-Oct. (In Russian)

A review is given of basic x-ray properties, experimental techniques, and design and performance of various spectroscopic instruments. 80 references. (R.V.J.)

8571

THE FAST NEUTRON SPECTROMETER. E. A. Zherebin, L. G. Andreev, and D. V. Timoshuk. Pribory i Tekh. Eksp. No. 5, 29-32(1959) Sept.-Oct. (In Russian)

Descriptions are given of a telescope-type neutron spectrometer employing two scintillation counters. The neutron energy is determined by the sum of the counter pulse amplitudes from the recoiling protons formed in the first organic crystal and losing their energy in the second. Due to the joint radiation and detection functions in the same scintillation counter and to the method of summation, it is possible to use crystals with effective thickness equal to the maximum recoil proton track range. This increases the efficiency of the spectrometer and excludes the edge effects. Several characteristic spectra are plotted. (tr-auth)

8572

CIRCULAR DISPERSION APPARATUS FOR STUDYING HIGH ENERGY NEUTRON SCATTERING AT SMALL ANGLES. B. M. Golovin, V. P. Dzhelepov, Yu. V. Katyshev, A. D. Konin, and S. V. Medved. Pribory i Tekh. Eksp. No. 5, 33-5(1959) Sept.-Oct. (In Russian)

A scintillation counter telescope with an aluminum converter (neutron telescope) is used for measurements of neutron scattering at several hundred Mev. The apparatus is capable of measuring with low-intensity neutron beams and may be applied in experiments with neutron scattering at small angles. (tr-auth)

8573

CONTROLLED DIFFUSION CHAMBER. A. P. Komar, M. V. Stabnikov, and D. A. Yashin (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 36-40(1959) Sept.-Oct. (In Russian)

The design and performance of a diffusion chamber controlled by an ionization chamber are described. The ionization chamber, placed into the sensitive layer of a diffusion chamber, collects electron charges. Stereophototracks of α particles and electrons obtained with the apparatus are included. (tr-auth)

8574

DETERMINATION OF CERTAIN PARAMETERS FOR PHOTOMULTIPLIERS AND SCINTILLATORS. V. V. Matveev, G. K. Popkov, and A. D. Sokolov. Pribory i Tekh. Eksp. No. 5, 41-4(1959) Sept.-Oct. (In Russian)

An installation for rapidly determining photomultiplier parameters and selecting phosphors is described. A scintillation flush or neon tube is used as the light source. The apparatus is used for both solid and liquid scintillators. (tr-auth)

8575

AUTOMATIC SINGLE-CHANNEL AMPLITUDE ANALYZER WITH RECORDING OF SPECTRA. M. P. Sokolov. Pribory i Tekh. Eksp. No. 5, 54-60(1959) Sept.-Oct. (In Russian)

A single-channel pulse analyzer, AZA-T, which changes discrimination levels and records spectra automatically is described. The pulses after passing the differential opening in the discriminator are recorded by a memory computer. The recorded results are transferred to paper by a relay scheme. (R.V.J.)

8576

MODIFICATION OF AMPLITUDE ANALYZER OUTPUT PULSE TIME DELAY. G. P. Mel'nikov. Pribory i Tekh. Eksp. No. 5, 61-3(1959) Sept.-Oct. (In Russian)

A design is suggested for modifying the time-delay inconsistency of output pulses in amplitude analyzers. The design permits the use of coincidence schemes with resolving time, τ, less than 7×10^{-8} sec instead of the commonly used 10^{-6} sec and over. (tr-auth)

8577

HODOSCOPE OF SMALL DIAMETER COUNTERS WITH PULSE FEEDING. A. G. Morozov, K. G. Nekrasov, and M. I. Popov (Joint Inst. of Nuclear Research, Dubna, USSR). Pribory i Tekh. Eksp. No. 5, 64-8(1959) Sept.-Oct. (In Russian)

Studies were made of the performance of various gas-filled counters with pulse feeding, and the properties of the gases used are analyzed. The design and performance of a hodoscope with 7.5 mm counters filled with neon are described. (tr-auth)

8578

FINITE PULSE GENERATOR. V. V. Okorokov. Pribory i Tekh. Eksp. No. 5, 68-75(1959) Sept.-Oct. (In Russian)

A finite-pulse generator with quartz crystal stabilization at 1 μsec between pulses is described. Synchronizing pulses of 8 Mc generate, in the 1 μsec range, temporary vibrations equal to 0.12 μsec. The maximum damping conditions in the scheme are analyzed. The generator can produce a time scale in amplitude and time analyzers as well as signal phasing in relation to supporting high-frequency (4 to 20 Mc) pulses. (tr-auth)

8579

CASCADE INTENSITY MULTIPLIER WITH TRAVELLING WAVE. G. A. Vasilev (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 75-80(1959) Sept.-Oct. (In Russian)

Descriptions are given of a high-frequency cascade intensity multiplier. The number of cascades exceeds 10^3. The application of crystalline diodes allows intensities of several hundred kilovolts. The design and performance of the low voltage model are included. (R.V.J.)

8580

STABILIZED HIGH INTENSITY SOURCE OF 80 kv. V. V. Polivanov, A. V. Izyurov, and N. I. Pyatakov. Pribory i Tekh. Eksp. No. 5, 85-8(1959) Sept.-Oct. (In Russian)

With the change of the current load from 0 to 2.5 mamp and simultaneous change of incoming intensity from 270 to 190 v, the stabilized high-intensity source changes less than 1%. The stabilized intensity can be arranged in steps of 5 kv from 60 to 80 kv. The high-intensity stabilizer automatically switches on upon reaching 60 kv. (tr-auth)

8581

DEVICE FOR MEASURING X-RAY SCATTERING AT SMALL ANGLES. A. I. Slutsker and E. A. Egorov (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 89-94(1959) Sept.-Oct. (In Russian)

A device is described for measuring weak x-ray scattering at small angles (of the order of a fraction of a minute). The device is based on the principle of a wide "semi-finite beam" which secures a relatively strong output and small parasitic background. The scintillation recording of x-ray quanta was achieved with the device. (tr-auth)

8582

AN APPARATUS FOR MEASURING MAGNETIC FIELD WIDE RANGE INTENSITIES. A. N. Sus and N. N. Bog-

danov (Saratov State Univ.). Pribory i Tekh. Eksp. No. 5, 117-18(1959) Sept.-Oct. (In Russian)

An apparatus capable of measuring constant magnetic fields from a fraction of ev to 10 kev is described. The range is divided into four subdivisions: 0 to 10; 0 to 100; 0 to 1000; and 0 to 10,000 ev. The instrument is capable of measuring the mean value of the field within 5 mm^2. The calibration curves for the apparatus are linear with an order of accuracy of ~1%. (tr-auth)

8583

DOUBLE-CHANNEL SPECTROMETER FOR RECORDING COMBINED PHOTO-SCATTERING SPECTRA. V. A. Zubov, G. G. Petrash, and M. M. Sushchinskiĭ (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 119-20(1959) Sept.-Oct. (In Russian)

Descriptions are given of a spectrometer, with diffraction grid dispersion of 5.5 amp/mm, used in recording combined photo-scattering spectra. The instrument may be operated with one or both channels. In the latter event, the ratio between the spectral intensity lines and the excitation intensity lines is recorded and the instabilities are eliminated. (tr-auth)

8584

THERMOCOUPLE SYSTEM FOR MEASURING LARGE NEUTRON FLUX. Yu. K. Gus'kov and A. V. Zvonarev. Pribory i Tekh. Eksp. No. 5, 121-2(1959) Sept.-Oct. (In Russian)

A thermocouple system was designed for measuring neutron flux in a large γ background. The detector was tested in a reactor channel with neutron fluxes of 5×10^9 to 1.5×10^{13} neutrons/cm^2 sec. The weakness of the detector is its lack of linearity at high fluxes, a relatively high inertia, and a weak reaction to temperature and humidity changes. However, the detector is capable of fast and efficient measurements over a wide flux range with automatic compensation for γ background, is easy to handle, and simple in design. (R.V.J.)

8585

EVALUATION OF CORRECTIONS IN BETA MEASUREMENTS. G. G. Aref'ev. Pribory i Tekh. Eksp. No. 5, 123-4(1959) Sept.-Oct. (In Russian)

A method is suggested for evaluating the corrections in relative measurements of β source activity. The method is based on the experimental determination of the specific β activity (pulse/min to mg/cm^2) in relation to the thickness of the source (mg/cm^2). (tr-auth)

8586

WIRE-TYPE GAS COUNTERS. Yu. A. Prokof'ev and A. N. Sosnovskiĭ. Pribory i Tekh. Eksp. No. 5, 125-7(1959) Sept.-Oct. (In Russian)

Gas counters with wire cathodes and two types of grids (one consisting of 21 twelve-filament counters placed in two rows, with 10 in one row and 11 in the other) are described. The hexagonal counters (ϕ = 8 mm) fit tightly into each other, like beeswax cells, and some of the cathode filaments serve for two or three counters. Another type consists of seven large (ϕ = 13 mm) eight-filament counters placed in one row. The performance characteristics in recording decay electrons are included. (R.V.J.)

8587

DIFFERENTIAL IONIZATION CHAMBER FOR MONITORING SYNCHROTRON BREMSSTRAHLUNG EMISSION. M. P. Piskov and I. N. Usova (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 127-8 (1959) Sept.-Oct. (In Russian)

An improved, thin-walled ionization chamber with low sensitivity to electron background was designed for monitoring bremsstrahlung emission from a synchrotron. (R.V.J.)

8588

ON THE PERFORMANCE OF A LOW-PRESSURE DIFFUSION CHAMBER. V. K. Lyapidevskiĭ (Moscow Inst. of Engineering Physics). Pribory i Tekh. Eksp. No. 5, 131-2(1959) Sept.-Oct. (In Russian)

It is shown that reduced sensitivity taking place with a drop in pressure is related to the change in partial pressure and temperature distribution; the first condition is true for chambers with non-linear temperature distribution along the walls; the second for chambers with linear distribution. The appearance of a cellular structure in drop background was observed. Data are presented on the fluctuation of drop density as a function of pressure and nature of gas. (tr-auth)

8589

THE MIRROR DIFFUSION CHAMBER FOR WORKING IN MAGNETIC FIELD. A. P. Andreev and V. I. Bunyaev (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 133(1959) Sept.-Oct. (In Russian)

A schematic is presented of a mirror diffusion chamber capable of performing in homogeneous magnetic fields. (R.V.J.)

8590

DOSIMETRY AND APPLICATION OF A NEW APPARATUS WITH EXTRA-TRANSPARENT BERYLLIUM-WINDOW TUBE WITH WIDE UTILIZATION SPECTRUM (5 to 100 kv). A. Gilardoni and T. Ghislanzoni (Laboratori della Societa "Gilardoni," Milan). Radiol. med. 45, 989-96 (1959) Oct. (In Italian)

A new x-ray apparatus is described which has a tube with an extremely transparent Be window (0.25 mm thick) for a wide utilization spectrum (5 to 100 kv). Data are given on the intensity and quality of the radiation, the isodose curves, and the inherent dosimetry. Its principal applications are: therapy with narrow beams, x-ray causticization, plesiotherapy, surface therapy, irradiation at very high intensity (10^5 r/min), microradiography, plesiography, and normal- and high-contrast diagnosis. (tr-auth)

8591

SENSITIVE 4π DETECTOR FOR SCANNING RADIOCHROMATOGRAMS. Lothar L. Salomon (Univ. of Texas, Galveston). Science 131, 415-17(1959) Feb. 12.

A 4π detecting system is described for scanning unidimensional radiochromatograms of compounds labeled with weak beta emitters. The useful plateau is approximately 150 v, lying between 1275 and 1425 v, with a slope of less than 4% per 100 v. The background counting rate is 17.7 count/min. The following scanning data were determined: time constant, 40 sec; scanning rate, 6 in./hr; and full scale, 1000 count/min. (C.J.G.)

8592

THE USE OF A SCINTILLATION COUNTER IN X-RAY STRUCTURE ANALYSIS. D. M. Kheiker, I. E. Konstantinov, and V. A. Alekseev (All-Union Scientific Research Inst. of the Asbestos and Cement Industries; Ministry of the Building Materials Industry, USSR; and Moscow Engineering and Physics Inst.). Soviet Phys.-Cryst. 4, 48-53(1960) Jan.

An arrangement is described for registering an x-ray-diffraction pattern by means of a scintillation counter with a differential discrimination attachment. The apparatus consists of the detector itself plus a measuring system. Resolving time of the system is 2.5 to 3.0 μsec and inten-

sities at speeds of 3000 count/sec can be measured with an error of less than 1%. (auth)

8593

IMPROVEMENTS RELATING TO THERMAL APPARATUS. Douglas Richard Chick (to Associated Electrical Industries, Ltd.). British Patent 818,776. Aug. 26, 1959.

A reactor control system is described in which neutron-absorbing material such as Sm is placed in the core to prevent runaway. The neutron capture cross section of the Sm increases steeply with temperature, thus preventing unsafe conditions in the core. (T.R.H.)

8594

IMPROVEMENTS IN OR RELATING TO ELECTROMAGNETIC INTERACTION PUMPS. William George Hutchinson and Leslie Charlie Cole (to United Kingdom Atomic Energy Authority). British Patent 819,547. Sept. 2, 1959.

An electromagnetic pump designed for remote maintenance is described. The pump assembly is located in a gas-tight compartment behind a shielding wall. The stators are accessible by removal of a shield plug. (T.R.H.)

8595

RADIATION DETECTOR. Roy Pasqual Mazzagatti (to Texaco Development Corp.). British Patent 819,561. Sept. 2, 1959.

A pulse-type gas-amplification gamma detector for high-temperature service is described. The construction is of stainless steel, including cathode plates and anode wire. Techniques for constructing the device so as to have a minimum of oxidation and contamination of the filler gas are described. It can be outgassed at temperatures up to 800°F before filling. (T.R.H.)

8596

IMPROVEMENTS IN OR RELATING TO INSTRUMENTATION FOR NUCLEAR REACTORS. William Laws (United Kingdom Atomic Energy Authority). British Patent 827,436. Feb. 3, 1960.

A reactor safety device is described which co-relates signals from a neutron flux meter and a hot-wire anemometer in the coolant inlet duct. The anemometer has a Pt winding which, with a Manganin resistor, makes up a transformer the secondary of which provides output for amplifier positive feedback. The amplifier is a conventional type. The feedback causes oscillation in the amplifier which warms up the Pt winding so that its resistances approach that of the Manganin resistor. When the two resistances are equal, the loop gain in the oscillating circuit drops and the power supplied to the Pt coil is reduced until stable conditions obtain. With the temperature constant, changes in heat transfer between coolant and Pt winding cause changes in power supplied to the winding. A voltage corresponding to this power is combined with the flux meter output to produce a signal which is compared with an alarm signal. (T.R.H.)

8597

IMPROVEMENTS IN OR RELATING TO INDUCTION FURNACES. Herbert Noel Jones (to United Kingdom Atomic Energy Authority). British Patent 827,770. Feb. 10, 1960.

An induction furnace for melting and casting refractory metals is described which avoids glow-discharge difficulties. The melting zone is located above the casting zone. In operation, the crucible is raised to the head-box and loaded, then lowered to the melting zone. After evacuation and melting, the crucible is lowered to the casting zone and tilted to pour the charge into the mold. (T.R.H.)

8598

HIGH ENERGY RADIATION DETECTOR. (to General Electric Co.). British Patent 827,977. Feb. 10, 1960.

A transistor radiation detector is described. On an Al base a flash coating of Bi is applied to bond well with the p-type Se layer. The next layer is an n-type material such as CdSe(Ag) or CdS(Ag). Finally, a counter electrode layer of Cd or Zn is applied. Such a device is useful in the detection and measurement of x and gamma rays. (T.R.H.)

8599

IMPROVEMENTS IN OR RELATING TO ENERGY-DETECTORS. (to Philips Electrical Industries, Ltd.). British Patent 828,307. Feb. 17, 1960.

A transistor radiation-heat detector and circuit are described. As radiation increases above a fixed level, the cut-off bias of the base of the transistor is exceeded and collector current rises sharply. The base of the transistor is connected through an impedance which is high with regard to base-emitter forward resistance, but low for base-emitter reverse resistance. The device may be used to operate a relay or a meter. (T.R.H.)

Materials Testing

8600 WASH-733(p.274-330)

Naval Research Lab., Washington, D. C.

PROCEDURES DEVELOPED AT NRL FOR NOTCH TOUGHNESS EVALUATIONS. Peter P. Puzak. 57p.

The procedures are presented by which impact tests are employed for specifying the procurement of material which is expected to exhibit specific notch toughness characteristics. (W.L.H.)

8601

GAMMA-RADIOMETRIC INVESTIGATIONS OF REACTOR SHIELDING. Erik Somer (Isotopcentralen, Copenhagen). Atomwirtschaft 2, 63-6(1960) Feb. (In German)

The testing of reactor shielding using scintillation counters and gamma-ray sources has proved a cheaper and less time-consuming method for thick walls than radiography with Co^{60} and film. In investigations carried out up to now on thick lead shields the average defect has amounted to about 2%. The position of the defect is clearly marked on a life size diagram on the specimen by a stylus attached to the counter. The depth dimension of the defect is indicated on a recording potentiometer. The accuracy of the method is dependent on the thickness of the specimen and on the acceptable maximum porosity. It can be considerably increased by using a radiation source of greater activity and by a reduction of the scanning rate. (auth)

8602

BETATRON INSPECTION OF A THERMAL REACTOR SHIELD. Kurt Fink and Joachim Woitschach (Phoenix-Rheinrohr Aktiengesellschaft, Vereinigte Hutten- und Rohrenwerke, Dusseldorf). Atomwirtschaft 2, 67-71 (1960) Feb. (In German)

The determination of weakening in the walls of the copper cooling tubes in the lead cladding of the DIDO tank sheath has proved possible using radiography with the 31 Mev Brown-Boveri Betatron. The high intensity and energy of the radiation enabled radiographs of high image sharpness to be obtained using economical exposure times. A wire sensitivity of 0.4% was obtained through 250 mm of steel with the film in contact with the specimen. Using a radiographic enlargement of 2.5 : 1 a sensitivity of 0.2% was obtained. Bearing in mind the essentially improved image sharpness, during inspection at Phoenix-Rheinrohr, Mulheim all exposures on the DIDO tank sheath are made with a radiographic enlargement of 2 : 1. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

8603 AERE-HP/M-56

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ARRANGEMENT FOR MEASURING THE TEMPERATURE GRADIENT IN THE LOWER ATMOSPHERE. R. N. Crooks and A. E. R. Toureau. Aug. 6, 1953. 8p.

An arrangement which was set up at A.E.R.E. to measure the temperature gradient in the atmosphere is described. It incorporates a d-c amplifier the input of which is biased to enable both positive and negative gradients of temperature to be measured and a switching device to monitor continuously the biasing voltage applied. The range of temperature differences covered was ±5°F to an accuracy of 0.1°F and the equipment operated reliably over a considerable period with a minimum of attention. (auth)

8604 AFOSR-TN-59-158

Maryland. Univ., College Park.

PROPERTIES OF THE UPPER ATMOSPHERE DEDUCED FROM THE RADIATION BELT. S. F. Singer. [1959]. 23p. Contract AF49(638)-530. (AFCRC-TN-59-386; AD-211117).

Deductions on properties of the upper atmosphere are discussed. Calculations on air density variations in the exosphere are presented along with estimates of hydrogen concentration densities above 1000 km based on the intensities of radiation belts. From these and other data and deductions it is possible to calculate complete development of magnetic storms as a function of time, including the distribution of trapped protons and their magnetic effects. (J.R.D.)

8605 NP-8281

California. Univ., Berkeley. Hydraulic Engineering Lab. and California. Univ., Berkeley. Sanitary Engineering Research Lab.

FIRST ANNUAL REPORT ON SILT TRANSPORT STUDIES UTILIZING RADIOISOTOPES [FOR] OCTOBER 1956 TO DECEMBER 1957. R. B. Krone. 124p. Contract DA-04-203 CIVENG-57-61.

This research has been primarily concerned with the development of a means of measuring the movement of sediment. The movement of sands has been satisfactorily traced using ground glass containing dissolved gamma emitting radioisotopes. Simple sorption of gold-198 or scandium-46 on wet clayey sediments provides an inexpensive and convenient means of labeling these materials, without affecting their hydraulic properties. Knowledge of the physical properties of sediments is vital to an understanding of sediment behavior in San Francisco Bay as well as necessary to the application of tracing techniques. Sediments from San Francisco Bay contain large amounts of clay and silt. The clay minerals have a high cation exchange capacity and very small particle size. Because of these properties flocculation of the sediment particles in salt water occurs. The characteristics of the sediments which determine the mode of transport may be largely determined by the size, density, and stability of these flocs. The size of the flocs, and the settling velocity, are functions of the suspended sediment concentration. Consolidation of the settled sediment appears to occur in two distinctly different modes, which depend on sediment suspension concentration. At low concentrations the flocculent material settles directly into a stable bed, whereas the material in high concentrations forms a dense fluid which requires several hours before exhibiting resistance to shear. Large scale rapid mixing of the sediments in San Francisco Bay is evidenced by correlation between cation exchange capacities and particle size distributions of samples from widely scattered parts of the bay, while similar correlations do not occur among samples taken from source streams. (auth)

8606 NYO-3940

Massachusetts Inst. of Tech., Cambridge.

VARIATIONS IN ISOTOPIC ABUNDANCES OF STRONTIUM, CALCIUM, AND ARGON AND RELATED TOPICS. Seventh Annual Progress Report for 1959. Dec. 1, 1959. 247p. Contract AT(30-1)-1381. OTS.

The Reynolds-type mass spectrometer was installed and satisfactory operation was obtained. Four new gas purification trains and furnaces were constructed in a new consolidated system which shares spike release and mass spectrometer connections. New facilities for clay mineral research were developed which included ultrasonic equipment and a centrifuge. Progress was made on the new instrument for the measurement of Sr and Pb isotopic abundances, which will greatly extend the range of activity in geochronology and related subjects. The study of the K-Ar ratios in illitic sediments was pursued. The investigation of the change of Sr^{87} abundance in crustal material prior to the development of igneous or metamorphic rock bodies was continued. It was concluded that glauconite does not measure up to the full requirements of a means of measuring the age of sediments. Regional investigations were continued, as they form a background for future detailed studies, as well as continue to provide for the ultimate correlation of Precambrian areas over the earth and interpretations of early earth history. (For preceding period see NYO-3939.) (W.D.M.)

8607 RME-2038

Grand Junction Operations Office. Salt Lake Branch Office, AEC.

UNDERGROUND EXPLORATION OF THE QUARTZITE CAP CLAIMS, YELLOW JACKET AREA, MARYSVALE, UTAH. Stephen R. Steinhauser and Bert L. Myerson. Aug. 1955. 10p. OTS.

An 800-foot crosscut was driven on the Quartzite Cap claim 6 miles north of Marysvale in central Utah. The objective of the project was to determine the changes with depth of a typical mineralized zone which might serve as a standard for similar occurrences. No uranium minerals were encountered, and the only structural features found were fractures and joints. (auth)

8608

NEW DISCOVERIES OF URANIUM MINERALS IN ITALIAN LOCALITIES. Carlo Garavelli and Francesco Rinaldi (Comitato Nazionale per le Ricerche Nucleari, Florence, Italy). Atti soc. toscana sic. nat. Pisa. Mem. Ser. A 65, 147-64(1958). (In Italian)

Some specimens of minerals of the torbernite and metatorbernite group from Preit (Cozie Alps) and Camigliatello Silano (Calabria) were studied. The specimens from Preit deposits are formed by a member of the torbernite–zeunerite series, rarely associated with a member of the autunite–uranospinite series. The corresponding dehydration products have also been found. The lattice parameters of the various minerals have been calculated, and the geochemical significance of the presence of arsenates among the secondary minerals of many alpine uranium deposits is discussed. Autunite has been found at Camigliatello Silano; it has a considerably disordered reticular lattice, due very likely to the dehydration conditions of the mineral. (auth)

8609

SECONDARY URANIUM MINERALS OF THE SAN LEONE AREA (CAGLIARI). Carlo Garavelli, Fiorenzo Mazzi, and Francesco Rinaldi (Comitato Nazionale per le Ricerche Nucleari, Florence, Italy). Atti. soc. toscana sci. nat. Pisa. Mem. Ser. A 65, 237-61(1958). (In Italian)

Some secondary uranium minerals from San Leone (Sardinia), collected in proximity of the magnetite deposit are described. They are phosphuranylite, parsonsite, sabugalite, saléeite and metasaléeite, metatorbernite, and α-uranophane. The identification was carried out by means of diffractometric and spectrochemical methods, with the aid of optical studies. Many samples of sabugalite and saléeite show a very imperfect reticular lattice and strong optical anomalies with 2V up to 70°. The absence of As and the scarcity of Ca in those minerals are emphasized and discussed. Parsonsite, metasaléeite and sabugalite are new minerals for Italy; saléeite and phosphuranylite have been identified for the first time. (auth)

8610

USE OF RADIOISOTOPES IN APPLIED GEOLOGY. Immo Wendt (Bundesanstalt für Bodenforschung, Hanover). Kerntechnik 2, 1-9(1960) Jan. (In German)

The use of radioisotopes in the different fields of geology is considered. In particular, techniques are described which are used in measurements in deep wells (gamma and neutron logging), absorption and scattering measurements of moisture content, tracer studies in hydrology for conducting calculations in rainfall runoff, and utilization in mining. (tr-auth)

8611

COSMIC-RAY-PRODUCED SILICON-32 IN NATURE. Devendra Lal, Edward D. Goldberg, and Minoru Koide. Science 131, 332-7(1960) Feb. 5.

Sponges from the floor of the Gulf of California were chemically treated to remove silica. Silicon-32 was determined by milking and by counting the P^{32} daughter. The half life of Si^{32} was determined to be 13 ± 4 days. The average global production rate of Si^{32} in the atmosphere was determined to be 2.0×10^{-4} atoms/cm^2 per sec. The distribution of Si^{32} at various depths in the oceans was calculated. (C.J.G.)

8612

THE GEOCHEMISTRY OF THE RADIOACTIVE ELEMENTS IN THE PEGMATITE FIELD OF NORTHERN KARELIA IN RELATION TO THE PROBLEMS ON THE AGE OF THE BELOMORSKIYE (WHITE SEA) INTRUSIONS. L. V. Komlev. Trudy Radievogo Inst. im. V. G. Khlopina 5, Pt. 2, 230-55(1957).

The distribution of U and Th in the rocks of the pegmatite field, as well as in the pegmatite veins themselves, is discussed. The paragenetic relations of the radioactive minerals and the processes of their subsequent alteration were studied. The latest crystallization of radioactive minerals did not occur in the microcline-quartz veins. The sequence of mineral growth in the Chernaya Salma pegmatite veins is given. The paragenetic association separated from a pegmatitic melt out of which the principal mass of feldspar and quartz had earlier crystallized. The study of the mineral association and of the chemical composition of the mineral series attests to the importance of geochemical differentiation. This process led to considerable segregation, even of those elements which are distinctive in the formation of the overall crystallochemical structure. Although Th everywhere exceeds U in quantity, only rarely does it diverge from the ratio of the average content in the earth's crust. All the varieties of uraninite studied, which crystallized in various environments and formed in five different pegmatite veins, show a considerable constancy in the lead ratio. From the data on radioactivity in the pegmatites of northern Karelia, it must be assumed that the pegmatites are older than the post-Bothnian epoch. Their age has been determined to be on the order of 1800×10^{-6} years, which places them among the oldest Precambrian rocks in the world. (TCO)

HEALTH AND SAFETY INCLUDING DOSIMETRY

8613 AD-217714

[Tactical Air Command, Langley AFB, Va. OPERATIONS ANALYSIS WORKING PAPER NO. 64. Theodore H. Eklof. Apr. 13, 1959.] 18p.

When an atomic detonation occurs upwind of a position, a rapid estimation needs to be made concerning the radioactive fall-out effects due to that detonation in order that necessary defensive actions can be properly planned. A graphical method is presented whereby these estimations can be simply and rapidly made from a single, unclassified graph readily available to all interested personnel. The graph is entered using as inputs the size of yield and the distance downwind from the detonation. Several variables can then be selected such as roentgen dose and the length of time to stay protected. From these can then be determined the time after the detonation that personnel can leave protective shelters. The graph can alternately be used as a decision forming device to assist a commander to determine what doses he might have to subject his personnel to in order to accomplish given priority tasks. (auth)

8614 AFCRC-TN-59-201

Air Force Cambridge Research Center. Ionospheric Physics Lab., Bedford, Mass.

RADIOACTIVE AGGREGATES IN THE STRATOSPHERE. GRD Research Notes No. 10. Herman Yagoda. Mar. 1959. 24p. Project No. 8600. (AD-212423). OTS.

Dust collected from two balloon flights at 100,000- and 112,000-foot elevations have been tested for radioactivity by incorporating the dust particles into a nuclear emulsion and developing the tracks produced by associated alpha and beta particle emissions. The dust collected on a balloon launched at Minneapolis, Minnesota on August 16, 1958 exhibited 1.7 radioactive dust particles per cm^2 of collector surface after 11.5-hour flight above 60,000 feet. The fission-colloid concentration on this flight is about 1500 times greater than the corresponding sea-level fall-out in emulsions prepared in England in 1955. Details of emulsion preparation and development are described. A phenomenological classification of radioactive dust particles is presented together with photomicrographs of typical categories. (auth)

8615 AFCRC-TN-59-444

Air Force Cambridge Research Center. Atmospheric Circulations Lab., Bedford, Mass.

ARTIFICIAL RADIOACTIVITY FROM NUCLEAR TESTS UP TO NOVEMBER 1958. GRD Research Notes No. 19. E. A. Martell. Sept. 1959. 19p. Project 7690. OTS.

The production of fission products, carbon-14, and tritium in all United States, United Kingdom, and Soviet nuclear tests up to the end of 1958 is summarized and discussed. Major features of the atmospheric-mixing history and world-wide distribution of fall-out are outlined. Some major differences between United States and Soviet tests

are pointed out. Nuclear tracer experiments which will contribute to better understanding of atmospheric circulation and fall-out are briefly described. (auth)

8616 AFSWC-TN-59-6

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
SCATTERED GAMMA RADIATION MEASUREMENTS FROM A Co^{60} CONTAMINATED FIELD. Clayton L. Schlemm, Alexander E. Anthony, Jr., and Zolin G. Burson. Jan. 1959. 126p. Project No. 7806. (AD-210485).

A 90° sector of a circle of 604-foot radius was contaminated with cobalt-60 point sources to an approximate level of 1.72 millicuries per square foot, as a means of simulating an area approaching an infinite contaminated field. Radiation measurements were made in an open hole with a PDR-27A radiac instrument and Dupont 553 film to determine the percentage of the total radiation which is due to scattered radiation (skyshine). It was found to be approximately 10 ± 4 percent. These measurements were made at selected points from approximately 36 inches above to 25 inches below ground level. Data were obtained in a miniature basement to determine the attenuation of the skyshine by various thicknesses of concrete on the roof. Additional data were obtained to determine the energy of the scattered radiation as a function of the angle above the plane, using a total absorption gamma spectrometer. The unshielded effective energy for dose considerations ranged from 0.90 to 0.12 Mev for elevation angles from 10 to 80° above the plane. All the instrumentation was placed in the vicinity of the apex of the radiation field. (auth)

8617 CEX-59.1

Technical Operations, Inc., [Burlington, Mass.].
AN EXPERIMENTAL EVALUATION OF THE RADIATION PROTECTION AFFORDED BY A LARGE MODERN CONCRETE OFFICE BUILDING. J. F. Batter, Jr., A. L. Kaplan, and E. T. Clarke. May 1, 1959. 60p. OTS.

With this is bound Appendix A: Division of Biology and Medicine, Health Protection Branch, AEC. RADIATION-SAFETY OPERATIONS. James E. Turner.

An experimental study was made to determine the effective shielding provided by a modern reinforced-concrete office building (AEC Headquarters building) from nuclear fall-out. Pocket ionization chambers were used for measurement of the radiation-field strength. Fall-out was simulated with distributed and point-source configurations of Co^{60} and Ir^{192} sources. Four typical sections were selected for study, and experiments were performed on each. These included an external wing with exposed basement walls and an external wing with a buried basement. Roof studies were made on an internal wing with a full basement and on the east end of wing A, which has a thin-roof construction. The thick-roof construction of 8 in. of concrete and 2 in. of rigid insulation covers all the building except the east end of wing A, which has 4 in. of concrete and 2 in. of insulation. (auth)

8618 FFIF-IR-F-394

Norway. Försvarets Forskningsinstitutt, Kjeller.
RADIOACTIVE FALLOUT IN NORWAY 1959. T. Hvinden. Dec. 1959. 41p.

A review is given of fall-out monitoring in Norway during 1959. It appears that the mean residence time in the stratosphere of fall-out materials from 1958 weapons tests may be about 6 months or less, instead of 5 years or more as previously assumed. The deposition of short- and long-lived isotopes during the first 6 months of 1959 was higher than during previous years. Concentrations of fall-out materials in air and precipitation have since decreased and are now the lowest for many years. Estimates show that between October 1958 and October 1959 external radiation has probably given larger bone marrow and gonad doses than internal Sr-90 and Cs-137 radiation. (auth)

8619 NRL-4509

Naval Research Lab., Washington, D. C.
RADIOACTIVITY OF THE AIR. I. H. Blifford, Jr., H. Friedman, L. B. Lockhart, Jr., and R. A. Baus. Feb. 21, 1955. Decl. Sept. 16, 1959. 37p. Project No. NR 612-130. OTS.

Since 1949 the Naval Research Laboratory has operated a network of monitoring stations for the detection and collection of atmospheric radioactivity. This report presents an analysis of some of the results obtained. Data recorded in 1950 at various geographical locations show definite diurnal and seasonal variations in the natural radioactive products in the atmosphere. The concentrations in curies/cc of fission products in the air at ground level from early 1951 through late 1954 is given in graphical form for a number of locations in various parts of the world. Maximum activities of the order of 10^{-16} curie/cc were recorded after atomic explosions. It is apparent that the distribution of activity throughout the earth's atmosphere is not uniform. Correlations which have been made with both low and high level wind trajectories, seem to show that the clouds of fission activity follow fairly restricted paths. In considering the distribution of fission products from atomic explosions, it will not be valid to assume a uniform distribution in the total atmosphere of even one hemisphere. Perhaps the most striking aspect of the data is the long period of time over which radioactivity has been detected. Since early 1951, there have been few periods when fission products were not detectable by at least one of the NRL stations. At Washington, D. C. fission products in the air were detected during more than 70 per cent of the time from 1951 to the present. In 1952 less than 60 days were free of fission activity. (auth)

8620 TID-3543

Technical Information Service Extension, AEC.
WHOLE BODY COUNTERS. A Literature Search. Hugh E. Voress, comp. Jan. 1960. 10p. OTS.

Sixty-four references are included to both report literature and articles appearing in scientific journals on the design and use of whole-body radiation counters. (C.H.)

8621 USASRDL-TR-2059

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PLOTTING SCALE ML-556(XE-1)/UM. Bruce F. Watson. Aug. 1, 1959. 25p. (AD-226417).

Plotting Scale ML-556(XE-1)/UM is designed to speed and simplify the construction of the fall-out wind plot of fall-out prediction. The fall-out wind plot is a configuration through means of which the location of close-in fall-out can be predicted by considering the vertical and horizontal velocities of fall-out particles. The plotting scale is developed to fulfil the requirement for a convenient method of accounting for the changing rates of descent and horizontal displacements of fall-out particles as they move through the atmosphere. For purposes of simplification, it is assumed that the behavior of particles of all sizes present in a nuclear cloud is a function of the behavior of a spherical particle of density 2.5 and 140 microns in diameter. Horizontal distances traveled by this particle are found for vertical increments of 6000 feet through a consideration of the effects of wind velocity and atmospheric pressure on the horizontal displacement of the particle. These distances are correlated with standard map scales so that vector length values corresponding to Artillery zone wind

speeds can be indicated on the plotting scale. An azimuth dial facilitates the proper orientation of the scale on the chart. The physical makeup and directions for use of the plotting scale with standard map scales are described. Tables enable fall-out wind plots to be constructed on map scales for which figures appearing on the plotting scale are not directly applicable. (auth)

8622 USNRDL-TR-361

Naval Radiological Defense Lab., San Francisco.
COMPUTATION OF EARLY-TIME FISSION PRODUCT DOSE-RATE SPECTRA AND GAMMA-RAY AIR ATTENUATION. C. F. Ksanda and E. Laumets. Sept. 14, 1959. 41p.

On the basis of photon spectra measurement for short-time irradiations of U^{235}, fission-product dose-rate spectra are computed for 1.7 to 1550 seconds after fission. Air-attenuation curves that would result from point-isotropic sources having such spectral distributions are then computed. The fact that the attenuation curves are nearly straight lines when plotted against distance from the source on a semilogarithmic scale indicates that an effective attenuation coefficient, $\overline{\mu}$, can be used in computing the gamma-ray air attenuation. The attenuation is given by an expression of the form $F = \exp(-\overline{\mu}x)$, where the value $\overline{\mu}$ is an effective attenuation coefficient, varying with time after fission, that takes into account absorption and buildup of the gamma rays over the entire radiation spectrum. (auth)

8623 WT-372

Naval Radiological Defense Lab., San Francisco.
BETA-RAY AND GAMMA-RAY ENERGY OF RESIDUAL CONTAMINATION. E. Tochilin, P. R. Howland, S. H. Fitch, R. Golden, and J. T. Barrett. Apr. 1952. Decl. Oct. 16, 1959. 237p. Project 2.4a [of] OPERATION JANGLE. OTS.

By means of depth-dose measurements, obtained using photographic film packets, a study was made of the beta-ray energy and the ratio of beta-to-gamma ionization resulting from residual contamination following surface and underground shots of Operation Jangle. Measurements were also made of the residual gamma-ray energy. Gamma depth dose measurements were made in unit density material, and the gamma-ray spectrum of residual contamination was measured. A study was made on biological injury from particle inhalation. Data are included on external gamma dosage, mortality, and sacrifice times for sheep and dogs exposed during both surface and underground tests. (C.H.)

8624 AEC-tr-3969

CONTINUOUS MEASUREMENT OF THE RADIOACTIVE AEROSOL CONTENT OF THE AIR. W. Buchner. Translated for Los Alamos Scientific Lab. from Atompraxis 3, 382-8(1957). 11p. JCL.

A review of methods for collection and counting of radioactive aerosols in air is presented. Theoretical and practical aspects are discussed, and calculation methods are demonstrated by examples. (J.R.D.)

8625 AEC-tr-3980

GENERAL CONSIDERATIONS ON THE MEASUREMENT AND OBSERVATION OF RADIOACTIVITY IN WATER. A. Pfau. Translated for Los Alamos Scientific Lab. from Atompraxis 3, 389-98(1957). 14p. JCL.

An evaluation of methods and apparatus for use in monitoring radioactivity in water is presented. The principal forms in which water exists are discussed, and the natural and artificial radioactivity found in it under various conditions is considered. Eventual levels of artificial radioactivity are estimated, and the present situation is summarized. (J.R.D.)

8626 CEA-tr-A-639

LA MESURE DE LA RADIOACTIVITÉ DES PRÉCIPITATIONS ATMOSPHERIQUES. (Measurement of the Radioactivity of Atmospheric Precipitations). Klaus Stierstadt. Translated into French from Kosmos (Stuttgart) 53, 344-7 (1957). 17p.

The sampling of the atmosphere and measurement of its radioactivity are discussed. Two fundamental sampling means are described, one involving air filtration, the other involving collection of rain, snow, and other precipitation. A radioactivity measurement set-up is described. (T.R.H.)

8627

NOTE ON THE EXCHANGE OF IODINE BETWEEN THE ATMOSPHERE, LAND AND SEA. Bert Bolin (International Meteorological Inst., Stockholm). Intern. J. Air Pollution 2, 127-31(1959) Oct.

The deposition of I^{131} as observed in small scale experiments and also after the Windscale incident, are interpreted in the light of available measurements of I^{127} in the atmosphere and in plants. It is shown that the deposition velocity deduced from deposition of radio-iodine is representative of the gross transfer while the net flux from the atmosphere to a land surface is several orders of magnitude smaller. The observations show that plants use atmospheric iodine for their assimilation and that this may be their major source in spite of the indication that a larger portion of the atmospheric iodine is present in organic form and not readily available for assimilation. A residence time of 20 days for iodine in plants is deduced. (auth)

8628

RADIOPROTECTION AT REACTORS AND IN NUCLEAR PLANTS. M. Oberhofer and P. Kienle (Technische Hochschule, Munich). Kerntechnik 2, 20-7(1960) Jan. (In German)

A discussion begun in Kerntechnik 5, p.150(1959) is continued with consideration of the effectiveness and utility of quenched counting tubes and proportional counters as health physics instruments. (T.R.H.)

8629

THE EXPERIENCE OF DOSIMETRIC CONTROL AND DISPENSARY REGISTRATION OF WORKERS OF THE LABORATORY OF NUCLEAR PROBLEMS OF THE UNITED INSTITUTE OF NUCLEAR RESEARCH. V. P. Afanasev, V. A. Golovina, M. M. Komochkov, V. N. Mekhedov, K. O. Oganesyan, V. E. Rozhkov, A. M. Rozanova, and M. N. Fateeva. Med. Radiol. 5, No. 1, 6-18(1960) Jan. (In Russian)

Data on dosimetric control of personnel working on a synchrocyclotron during a period of operation of eight years are analyzed. (auth)

8630

DOSIMETRY IN X-RAY DIAGNOSIS INVESTIGATIONS OF CHILDREN. G. N. Apasov. Med. Radiol. 5, No. 1, 46-50 (1960) Jan. (In Russian)

400 measurements of the dose of irradiation of children in various roentgenological investigations revealed that as the result of small size, negativeness, and mobility of the patients, almost in all types of roentgenological investigation are under conditions of total irradiation. During the most common procedure, investigation of the thoracic organs, the abdomen is always subject to irradiation in children. In numerous examinations these conditions could influence the development and health of the child. Such ir-

radiation can lead to serious genetic hazards, in that in routine conditions, the sex glands of children are also always irradiated. The side-action of ionizing radiation can be considerably reduced by taking roentgenograms instead of radioscopy and adequate protection of areas of the body which are not subject to examination. (auth)

8631

PHYSICAL PRINCIPLES IN THE CHOICE OF THE TECHNIQUE OF β-IRRADIATION. K. K. Aglintsev and V. P. Kasatkin. Med. Radiol. 5, No. 1, 52-8(1960) Jan. (In Russian)

A system of dosimetry of β radiation, based on spectral investigations in the fields of β-radiators, is given. It is shown that with the change of dimensions of the source and depth of the medium, the values of the dose per β particle for the given isotope (with simple β spectrum) remain practically constant. The dose values per β particle and the distribution of the dose throughout the irradiated medium for S^{35}, W^{185}, Tl^{204}, Y^{91}, P^{32}, $Sr^{90} + Y^{90}$, and $Ce^{144} + Pr^{144}$. A criterium is established for the choice of the isotope and dimensions of the source for providing optimal conditions of irradiation at a given depth. (auth)

8632

PRINCIPAL PROBLEMS OF LABOR HYGIENE IN RADIOACTIVE MINERALS OUTPUT. A. V. Bykhovskiĭ. Med. Radiol. 5, No. 1, 60-6(1960) Jan. (In Russian)

Hygiene in work with radioactive minerals is discussed. Attention is given to the health hazards of radon in the mining industry. (C.J.G.)

8633

THE DISTRIBUTION OF RADIOACTIVE POLLUTIONS IN A STAGNANT RESERVOIR. A. L. Agre and V. I. Korogodin. Med. Radiol. 5, No. 1, 67-73(1960) Jan.

The role of various components of a reservoir (water–bottom deposits–biomass) in the distribution of radioactive pollutions is discussed. The constancy of sorption coefficients of ground (water and biomass) water in preserving a value of 10^2 and 10^3 at a water pollution range of 10^{-6} to 10^{-9} c/l is demonstrated. The role of the biomass as the reservoir-deactivator is formulated as: acceleration of the transfer of radioactive substances in a bound condition from the water to the bottom, creation of a physicochemical regimen, preventing radioactivity desorption from bottom deposits, and a continuous formation of bottom deposits with a high sorption capacity. Calculations for determining the various aspects of a stagnant reservoir activity as a deactivator are given. (auth)

8634

MEASUREMENT OF AMBIENT RADIOACTIVITY (MARCH 1957–DECEMBER 1958). PART II. L. Argiero, S. Manfredini, and G. Palmas (Corso per le Applicazioni Mediche dell' Energia Nucleare, Leghorn). Minerva nucleare 3, 421-7(1959) Dec. (In Italian)

The results of the fall-out measurement in the Livorno, Siena and S. Giusto stations are described. Afterwards water samples in the neighborhood of Pisa and Livorno were examined to measure Sr^{90}. A description of instrumentation used in these measurements is included. (auth)

8635

TIME OF RESIDENCE OF RADIOACTIVE DEBRIS IN THE STRATOSPHERE. J. Ambrosen (Finsen Memorial Hospital and Radium Centre, Copenhagen). Nature 185, 301-2 (1960) Jan. 30.

A presentation is made of some views which concern the time of residence of radioactive debris in the stratosphere. Formerly the mean time of residence was assumed to be 10 ± 5 years; evaluations at middle latitudes indicate a shorter period, 2 to 4 years. Determinations were made, along a 2000 mile line extending from Denmark to Greenland, of the ratio of strontium-89 to strontium-90 contained in monthly samples of precipitation. A plot is presented for this ratio and the corresponding month. It is inferred, from the increase in the ratio, that 40 to 50% of the strontium-90 fall-out in the period February–June comes from the weapon tests which stopped around November 1, 1958. (B.O.G.)

8636

SOMATIC RADIATION DOSE FOR THE GENERAL POPULATION. The report of the Ad Hoc Committee of the National Committee on Radiation Protection and Measurements, May 6, 1959. Science 131, 482-6(1960) Feb. 19.

At its meeting in November 1958, the executive committee of the National Committee on Radiation Protection and Measurements undertook to re-examine the problem of exposure of the population to man-made radiations from the point of view of somatic effects as distinct from genetic effects. It was concluded that the present data are still insufficient to establish the character of the dose-response curve for somatic effects. It was also concluded that at present there is insufficient knowledge of the mechanisms involved to serve as a guide in areas where the data are not available. The committee favored prudence in estimating the effect of low doses. It was decided to adopt as an assumption that a proportional relationship between dose and effect exists. This signifies that no threshold exists, that the radiation dose is completely cumulative, and that the effect is independent of the rate at which the radiation is delivered. The assumptions on which these conclusions were reached are briefly outlined and are discussed. (C.H.)

8637

TRANSPORT OF STRONTIUM-90 IN RUNOFF. Ronald G. Menzel (U. S. Dept. of Agriculture, Beltsville, Md.). Science 131, 499-500(1960) Feb. 19.

Only a small portion of the strontium-90 that fell on cultivated soils was removed in runoff. The concentration of strontium-90 was usually about 10 times higher in the soil carried by the runoff than in the soil from the plow layer of the plots. Thus, a considerable concentration of Sr^{90} could occur in areas where runoff sediments accumulate. (auth)

8638

HEALTH PHYSICS INSTRUMENTATION. John S. Handloser. International Series of Monographs on Nuclear Energy. Division V. Health Physics. Volume I. New York, Pergamon Press, 1959. 190p. $6.50.

Health Physics Instrumentation contains descriptions, characteristics, and uses of the common types of radiation detectors used by health physicists. The book is primarily designed for those beginning to use radiation and who wish information concerning the basic health physics instrumentation procedures. A bibliography follows every chapter, and a general bibliography is included giving some general works on health physics. (C.H.)

8639

SAMPLING MICROBIOLOGICAL AEROSOLS. Harold W. Wolf, Peter Skaliy, Lawrence B. Hall, Marvin H. Harris, Herbert M. Decker, Lee M. Buchanan, and Charles M. Dahlgren. Public Health Monograph No. 60. Washington, D. C., Public Health Service, 1959. 58p. $0.45(GPO)

Samples and equipment for use in bacterial air sampling are described and illustrated photographically. Various

methods used for bacterial air sampling are discussed. It is pointed out that consideration should be given to the determination of particle size when studying airborne micro-organisms and their relation to respiratory infections, since the amount of particulate material and bacteria retained in the respiratory system is largely dependent upon the size of the inhaled particles. Some examples are included of airborne bacterial concentrations likely to be found in various environmental situations. Factors influencing the concentrations of airborne bacterial particulates are discussed. (C.H.)

ISOTOPE SEPARTION

8640 GAT-DM-819

Goodyear Atomic Corp., Portsmouth, Ohio.

AXIAL DIVERGENCE CALCULATIONS. D. L. Thomas. Feb. 23, 1960. 5p. Contract [AT(33-2)-1]. OTS.

An IBM-650 computer program was written to solve the equations involved in determining the correction factor for axial divergence to be used for precision lattice parameter measurements. IBM-650 operating instructions for the above program are given. (C.J.G.)

8641 NYO-7348

Kidde (Walter) Nuclear Labs., Inc., Garden City, N. Y.

APPLICABILITY OF GAS CENTRIFUGE TO ISOTOPE SEPARATION FOR ELEMENTS HEAVIER THAN TITANIUM. J. J. Barker. Sept. 30, 1956. Decl. Feb. 1, 1960. 52p. Contract AT(30-1)-1374, Final Report on Task VI-A. (WKNL-71). OTS.

The applicability of the gas centrifuge to the separation of the isotopes of the elements from Ti through U was examined. The suitable elements were determined, and their effects on required centrifuge characteristics were surveyed. The performance of cascades of various sizes with different gases was explored, and the cost of a pilot plant program to develop basic separation data was estimated. (F.S.)

8642

ISOTOPE EFFECT FOR SEPARATION OF OXYGEN ISOTOPES O^{16} AND O^{18} BY DISTILLATION OF LIGHT AND HEAVY WATER. Peter Baertschi and Max Thurkauf (Universität, Basel). Helv. Chim. Acta 43, 80-9(1960). (In German)

The vapor-liquid separation factors of the isotopic systems $H_2^{16}O/H_2^{18}O$ and $D_2^{16}O/D_2^{18}O$ have been determined by means of Rayleigh-distillation of H_2O and D_2O respectively. The results obtained by mass-spectrometric evaluation of the isotopic composition of oxygen in the water samples show that the separation-parameter ($\delta = \ln \alpha$) of the system $D_2^{16}O/D_2^{18}O$ is some 10 to 15% lower than that of the system $H_2^{16}O/H_2^{18}O$. The temperature dependence of the separation-parameters of both systems is given, showing generally poor agreement with the results of other authors concerning the system $H_2^{16}O/H_2^{18}O$. This investigation leads to a general principle stating that in compounds containing two species of isotopic elements, the isotope effect of the first element upon the separation-factor of the isotopes of the second element has the same magnitude as the isotope effect of the second element upon the separation-factor of the isotopes of the first element. (auth)

8643

COMPLEX EQUILIBRIA FOR DEUTERATION BY REPEATED EXCHANGE. T. Bürer and Hs. H. Günthard (Eidgenössische Technischeń Hochuschle, Zürich). Helv. Chim. Acta 43, 161-7(1960). (In German)

The equilibrium concentrations of isotopic species, which occur in deuterium-hydrogen exchange experiments with molecules containing n hydrogen atoms exchangeable with deuterium from deuterium oxide, are discussed. It is shown that the equilibrium concentrations of the isotopic species may be obtained from one equation, by which the composition of the product in consecutive exchange operations may also be calculated. The equation is used for the computation of tables of isotopic composition, as a function of number of exchange steps, purity of heavy water and molal ratio deuterium oxide/compound, for molecules with four exchangeable hydrogen atoms. A few practical rules resulting from the tables are formulated. (auth)

8644

A FUNDAMENTAL STUDY ON THE ION EXCHANGE SEPARATION OF ISOTOPES. II. THE INFLUENCE OF THE DIELECTRIC CONSTANT OF SOLUTIONS AND THE DEGREE OF CROSS-LINKING OF RESINS ON THE SEPARATION COEFFICIENT BETWEEN $^{14}NH_4^+$ AND $^{15}NH_4^+$. H. Kakihana, T. Nomura, and K. Kodaira (Tokyo Inst. of Tech., and National Inst. of Agricultural Science, Tokyo). J. Atomic Energy Soc. Japan 1, 419-24(1959). (In Japa-

Selectivity coefficients, $K_{14}^{15}(N)$, between $N^{15}H_4^+$ and $N^{14}H_4^+$ on sulfonated polystyrene divinylbenzene copolymers of various crosslinking, were determined in ethanol-H_2O mixtures containing 0.1 M NH_4Cl. The obtained values for $K_{14}^{15}(N)$ lie between 0.999 and 1.006. It seems that the maximum value for $K_{14}^{15}(N)$ is located at about 20 to 30 vol.% ethanol mixture. There is an appreciable increase in the $K_{14}^{15}(N)$ value with increasing crosslinking of the cation exchangers. The experimental data are discussed from a thermodynamic point of view. (auth)

8645

ISOTOPE SEPARATION BY A HOT-WIRE THERMAL DIFFUSION COLUMN. S. C. Saxena and W. W. Watson (Yale Univ., New Haven). Phys. Fluids 3, 105-9(1960) Jan.-Feb.

The performance of a hot-wire thermal diffusion column is discussed. The role of spacers used for centering the hot wire was investigated experimentally for a glass column of 9-mm i.d. cold wall, and hot wall 20-mil tungsten wire; the results suggest that the maximum separation is obtained when the spacers (20-mil nickel wire) are installed every 70 cm along the hot wire. The separation falls when the spacers come either closer together or farther apart. An explanation of this optimum dependence of separation on spacer distance is advanced. (auth)

8646

METHOD OF MANUFACTURING WATER OR HYDROGEN SULFIDE RICH IN DEUTERIUM. Paul Harteck (Renssalaer Polytechnic Inst.). British Patent 818,777. Aug. 26, 1959.

A deuterium separating process is described. Water and H_2S flow countercurrently in two vessels connected in series and maintained at different temperatures. Deuterium-enriched liquid is withdrawn between the vessels. The temperatures of the two regions are +40°C and −40°C. (T.R.H.)

8647

CHARGE RECEPTACLES FOR USE IN ION SOURCE UNITS. (to United Kingdom Atomic Energy Authority). British Patent 819,521. Sept. 2, 1959.

A device is described which contains the material to be charged to a calutron and feeds the material into the arc chamber. A tall cylinder with a lid contains a charge bottle and is equipped with a closure or valve which is opened by the magnetic field of the calutron to allow the charge to pass into the arc chamber. (T.R.H.)

8648
PROCESS FOR RECOVERING DEUTERIUM. (to Stamicarbon N. V.). British Patent 826,962. Jan. 27, 1960.

A modification is offered for a D recovery process involving countercurrent flow of H_2 and H_2O with catalytic exchange of D from H_2O to H_2. The H_2 stream containing D is cooled in a reversible heat regenerator to remove contaminants before distillation of D from it. The depleted H_2 is then recycled through the regenerator to pick up the solidified contaminants and be re-used. (T.R.H.)

MATHEMATICS AND COMPUTERS

8649 AECU-4660
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT [FOR] OCTOBER 1959. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. SWITCHING CIRCUIT THEORY. PART III. ILLIAC USE AND OPERATION. PART IV. IBM 650 USE AND OPERATION. PART V. GENERAL LABORATORY INFORMATION. 31p. OTS.

Progress is indicated in the high-speed computer program and switching circuit theory. Illiac and IBM-650 use and operation are summarized. (For preceding period see AECU-4615.) (W.D.M.)

8650 NP-8332
Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
AUTOMATIC SELECTION OF INITIAL VALUES FOR ITERATIVE PROCEDURES. Robert B. Polansky. Sept. 1959. 52p. Contract AF33(038)-24007.

A generalized scanning procedure for selecting initial values for iterative procedures for finding the zeros of arbitrary functions of N variables is described. The method can be applied to the following situations: (1) where the iterative procedure diverges for all initial values outside a small neighborhood of each zero; and (2) where it is necessary to obtain several or all of the zeros of some function. The method was programmed for the IBM 704 digital computer. Several test cases are presented. (C.J.G.)

8651 SCTM-338-59(15)
Sandia Corp., Albuquerque, N. Mex.
A DATA LINEARIZATION SYSTEM FOR USE WITH APAR (TABLE LOOK-UP). J. Marcon, Jr. Nov. 12, 1959. 32p. OTS.

A description is given of an automatic table look-up system for linearizing the digitized voltage output of transducers used with APAR into the units of the measured parameter. The table look-up uses paper storage for the calibration curves of particular transducers. The control system intercepts the output of APAR's digitizer and replaces this information with the appropriate stored information, which is then written (with proper address) on APAR's output tape. The operation sequence of data linearization, table look-up tape format and preparation, and circuit descriptions are contained. (C.J.G.)

8652 NP-tr-338
RAPID-ACTION ELECTRONIC COMPUTER OF USSR ACADEMY OF SCIENCES. (Bystrodeystvuyushchaya Elektronnaya Schetnaya Mashina Akademii Nauk SSSR). A. A. Pavlikov. Translated from a publication of the Academy of Sciences, U.S.S.R., Moscow, 1957. 132p. OTS.

A description is given of the magnetic memory device for the electronic computer of the USSR Academy of Sciences. The materials used, construction, and operation of the magnetic memory device are described. (W.L.H.)

8653 SCL-T-293
ITERATIVE SOLUTION AND ERROR ESTIMATE IN THE OVERDETERMINED LINEAR SYSTEM CALCULATION. CHAP. 2. NUMERICAL TREATMENT OF THE OVERDETERMINED PROBLEM. CHAP. 3. ESTIMATES FOR THE SQUARE SUM OF THE CORRECTIONS. (EXCERPTS). (Iterative Lösung und Fehlerabschätzung in der Ausgleichsrechnung. Kapitel. 2. Numerische Behandlung der Ausgleichungsaufgabe. Kapitel. 3. Abschätzungen für die Quadratsumme der Verbesserungen). Peter Läuchli. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. angew. Math. u. Phys. 10, 245-80(1959). 19p. JCL.

A numerical treatment of the overdetermined problem is presented and is transposed to the normal equations of the mediating compensation. Also, the calculation prescription is derived for the conditional compensation according to the method of conjugated gradients. A discussion of methods for estimates for the square sum of the corrections is included. (J.R.D.)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

8654 AD-218140
Battelle Memorial Inst., Columbus, Ohio.
METALLURGICAL RESEARCH AND DEVELOPMENT IN ELECTRON DEVICES. Quarterly Progress Report No. 1 [for] December 15, 1958–March 14, 1959. D. J. Maykuth, G. S. Root, R. I. Jaffee, J. B. Baker, G. B. Gaines, J. J. Vagi, and P. J. Rieppel. 24p. DA Project No. 3-99-15-104. Contract DA-36-039-SC-78253.

High-purity Nb, Hf, and a number of binary alloys with both base metals were evaluated for use as grid and/or construction materials in electron-tube devices. Suitable fabrication procedures were developed for processing Nb and Nb alloys containing 0.65% Zr or 40% Ta to fine wire and thin strip. Experiments to develop a suitable fabrication procedure for processing Hf and its alloys to similar wrought forms are in process. Studies were also initiated to define the nature and causes of troublesome recurrent weld defects in electron tubes. This problem is being approached by means of a literature search and plant visits. Information obtained from these sources is summarized. (auth)

8655 AD-219923
Cincinnati. Univ. Research Foundation.
RESEARCH ON THERMODYNAMIC INVESTIGATION OF CERAMIC MATERIALS AT ELEVATED TEMPERATURES. Quarterly Report for the period March 1, 1959–June 1, 1959. Michael Hoch. June 25, 1959. 7p. Project No. 7021. Contract AF33(616)-6299.

Boron phosphide was prepared by mixing degassed boron with red phosphorus and heating in a phosphorus stream to 1300°C for 30 minutes. An x-ray-diffraction pattern revealed an fcc structure with a lattice constant of a_0 = 4.52 A. Decomposition of the boron phosphide was studied. Data gathered from a literature search on the Zr–Cr–O system are presented. (C.J.G.)

8656 AD-220420
New York Univ., New York. Coll. of Engineering.
STUDY OF THE REACTION RATES BETWEEN REFRACTORY OXIDES AND GRAPHITE. Quarterly Progress Report No. 3 [for] March 16–June 15, 1959. Kurt L. Komarek and A. Coucoulas. 10p. Contract AF33(616)-6082.

Testing of a high-temperature, high-vacuum resistor furnace is reported. A temperature of 1700°C was reached after which a vacuum of 2×10^{-6} mm was attained at slightly lower temperature. Modifications such as installation of baffles to prevent pump oil condensing in the furnace and development of Mo–W and carbon heating elements which can be used interchangeably are reported. Results of a literature survey on oxide properties are tabulated. (J.R.D.)

8657 AECU-4669

Los Alamos Scientific Lab., N. Mex.

RESULTS OF EXPERIMENTS MADE WITH U.S.B.M. ELECTROCERIUM. W. N. Miner. Feb. 26, 1959. 8p. OTS.

Data obtained in tests of Bureau of Mines electrocerium are presented. The cerium was subjected to spectrochemical analysis, x-ray-diffraction analysis, thermal analysis, metallographic tests, and high-pressure experiments. (J.R.D.)

8658 AECU-4692

General Atomic Div., General Dynamics Corp., San Diego, Calif.

A SURVEY OF NON-FUEL-BEARING MATERIALS FOR THE MARINE GAS-COOLED REACTOR. J. C. Bokros, L. Dijkstra, and U. Merten. May 1, 1958. 52p. Project No. 40. Contract AT(04-3)-187. (GAMD-316(Pt. I)). OTS.

Results of an initial examination of non-fuel-bearing materials for the Marine Gas Cooled Reactor are presented. Areas given specific attention include structural and cladding materials and graphite moderator. Other areas not included because of classification include zirconium hydride moderator and control materials. In each report section, available pertinent information is summarized and a plan for future work is given. (J.R.D.)

8659 ANL-5960

Argonne National Lab., Lemont, Ill.

FUEL DEVELOPMENT FOR THE TREAT REACTOR. R. C. Lied and J. H. Handwerk. Jan. 1960. 19p. Contract W-31-109-eng-38. OTS.

Several methods for dispersing urania in graphite were evaluated to determine a suitable method for fabrication of fuel for the TREAT Reactor. Urania was introduced by immersing graphite shapes in alcohol and acetone solutions of uranyl nitrate, followed by heat treatment to convert to the oxide. UO_2 and U_3O_8 were mixed with carbon flour and a thermoplastic binder. During mixing the temperature was raised to the softening point of the pitch binder, causing the uranium oxide to maintain dispersion during subsequent handling. The mixed material was compacted at a temperature just under the softening point of the pitch. After fabrication the pieces were slowly baked to 950–1000°C to dissociate the bond. After removal of the volatiles the ware was fired to 2000–2500°C to graphitize the carbon. Graphite flour and U_3O_8 were mixed with both thermoplastic and thermosetting resins, compacted and slowly heated to 950–1000°C. By using graphite flour in place of carbon the graphitizing heat treatment was eliminated. This method appeared to be the simplest to produce a satisfactory dispersion. (auth)

8660 CEA-1090

France. Commissariat à l'Énergie Atomique, Paris.

LE BERYLLIUM. (Beryllium). P. Mouret and A. Rigaud. 1959. 22p. Internal Report No. 137, Jan. 15, 1958.

After a brief summary of the physical and chemical properties of beryllium, the various chemical treatments which can be applied to beryllium minerals either directly or after a physical enrichment are discussed. These various treatments give either the hydroxide or beryllium salts, from which either beryllium oxide or metallic beryllium can easily be obtained. The purification, analysis and uses of beryllium are also briefly discussed. (auth)

8661 CRFD-877

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE IRRADIATION OF ALUMINUM–PLUTONIUM ALLOYS IN ZIRCALOY-2 SHEATHING. PART II. PRE-IRRADIATION EXPERIMENTS ON ALUMINUM–PLUTONIUM ALLOYS. T. I. Jones. June 1959. 35p. (AECL-937). AECL.

Experiments were carried out with aluminum–plutonium alloys, containing up to 20 wt.% plutonium, to assess their potential value for water-cooled power reactors. Metallographic examinations and hardness determinations were carried out on cast and annealed alloys and the densities of cast alloys were determined, for comparison with irradiated alloys. Interactions between Zircaloy-2 and aluminum-plutonium alloys were studied by subjecting sheathed alloys to various thermal treatments. Liquation of the core alloys caused rapid sheath dissolution, 0.025 in./h at 660°C. Interaction was relatively slow at sub-solidus core temperatures, from 0.0015 to 0.006 in. in 26 hours at 636°C depending on the core composition. Interaction would be insignificant in water-cooled power reactors with core temperatures of 300 to 400°C. Corrosion rates of the bare alloys in 340°C de-ionized water in an AISI 316 stainless-steel autoclave varied with composition. The 5 wt.% alloy corroded $\sim 3 \times 10^{-3}$ in./h, and the 20 wt.% alloy corroded only 1.5×10^{-3} in. in $6\frac{3}{4}$ days. The 10 and 15 wt.% alloys possessed intermediate rates. The 5 wt.% alloy in defected Zircaloy-2 cans underwent less attack than in the bare condition, $\sim 2 \times 10^{-3}$ in. in 20 hours. Anodically treated 5 and 10 wt.% alloys in defected sheaths showed no corrosive attack after 20 hours at 340°C. (auth)

8662 DM-58

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE RETURN OF ESCAPED FISSION PRODUCT GASES TO UO_2. W. B. Lewis. Jan. 21, 1960. 49p. (AECL-964). AECL.

Preliminary experimental results appear consistent with the hypothesis of J. A. Davies by which fission fragments passing through a space filled with escaped fission product gases knock on a certain number of the gas atoms with sufficient energy, 2 kev or more, to penetrate through solid surfaces and become trapped. The number of gas atoms knocked on is supposed proportional to the fraction of the fission fragment energy expended in the gas. If the kinetic energy of a pair of fission fragments were expended entirely in fission gas, the number of atoms knocked on with sufficient energy is set as K, but only a fraction G of these will remain embedded. By irradiating small pieces of sintered UO_2 in capsules filled with natural xenon at several pressures and analyzing the embedded xenon relative to the fission gas produced, Kelly, Morgan, and Jones obtained a series of results that indicate $GK \approx 100$. In an earlier experiment, Hawkings, Morgan, and Jones irradiated a full-size UO_2 fuel rod in an atmosphere of natural argon, krypton, and xenon. Analyzing the gases embedded in oxide samples subsequently taken from various positions in the rod, led to complex results, but setting $GK = 100$ or possibly more, reveals an intelligible pattern that is discussed at some length. The mechanisms of fission gas escape are classed primarily as fission recoil, "knock-out," and diffusion. The last has commonly been related to the simple Booth model of diffusion from an aggregate of

spheres, but evidence is presented from the experiments of MacEwan and Lawson of much more complex processes involving migration of voids up the thermal gradient by an evaporation process; other processes of grain growth and thermal diffusion are also postulated. To evaluate the behavior of fission gases in practical UO_2 fuel, the volume is divided into several zones, namely compacted or sintered oxide below 1000°C, oxide between 1000 and 1600°C, sintered and deformable oxide above 1600°C, closed porosity, interconnected open porosity, and extra spaces such as end gaps that are cool and axial voids that are hot. For the return of escaped fission gases, porosity in the oxide that is below 1600°C, and especially that below 1000°C, is shown to be valuable. (auth)

8663 HW-27885

Hanford [Atomic Products Operation], Richland, Wash.

OUTGASSING TESTS OF URANIUM SLUGS. H. A. Johnson. May 27, 1953. Decl. Jan. 28, 1960. 5p. OTS.

Investigations to determine the volume of gas evolved from U slugs at simulated canning temperatures were conducted. It was found that more gas was evolved from salt-bath heat-treated slugs and recovered slugs than from slugs machined from alpha-rolled or salt-bath heat-treated rods. Surface machine marks and other surface imperfections also increased evolved gas volume. Gas evolution was thought to be a major factor in the reject rate. (J.R.D.)

8664 HW-32186

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DEVELOPMENT OF ULTRASONIC UNBOND TEST. C. L. Frederick. June 22, 1954. Decl. Jan. 28, 1960. 14p. Contract W-31-109-Eng-52. OTS.

An ultrasonic method of detecting voids and unbonded areas between the can and slug was developed. Tests were run on over 500 slugs for correlation with the frost test, autoradiographs, and destructive tests. Good correlation resulted from these tests with small inconsistency and transient rejections. The addition of a counter to indicate the total unbonded area improved the reliability of the test. The present equipment is shown to be as good as the frost test, though rejecting more slugs for many small voids. Improvements in the equipment are now in progress, and a usable production type instrument will soon be completed. (auth)

8665 KAPL-M-REM-1

Knolls Atomic Power Lab., Schenectady, N. Y.

PROCESS DESCRIPTION FOR COVERING METAL WITH A LAMINATED CERAMIC COATING. R. E. Mistler, A. T. Muccigrosso, and G. L. Ploetz. Dec. 18, 1959. 10p. Contract W-31-109-Eng-52. OTS.

A process was developed for coating metal parts with 10 to 15 μ of a laminated, electrically resistant, mechanically strong, heat resistant ceramic material consisting of alternate layers of dense TiO_2 and Al_2O_3 using Na_2SiO_3 as a binder for the alumina. A description of the process is given. (auth)

8666 LAMS-2396

Los Alamos Scientific Lab., N. Mex.

QUARTERLY STATUS REPORT OF THE LASL PLASMA THERMOCOUPLE DEVELOPMENT PROGRAM FOR PERIOD ENDING DECEMBER 20, 1959. Samuel Glasstone, comp. and ed. Jan. 1960. 21p. Contract W-7405-eng-36. OTS.

An operating cell was designed for an in-pile test to determine the operating characteristics as a function of pin temperature and of cesium vapor pressure. The cell failed after about 15 minutes operation. In order to study the effects of the work function of the emitter, on the output of the plasma thermocouple cell, the standard $\frac{5}{8}$-in. button was replaced by one with ten deep slots cut parallel to a diameter. The thermal conductivity of the Rokide A coating was measured. A cell with a cavity emitter was investigated. Fission product diffusion from a ZrC–UC pin was measured after irradiation and heating to 2400°C. Work was started on a plasma cell with a guard-ring construction for the purpose of studying the basic physical properties of the system. Work was done to determine how small the concentration of UC can be made before the electron emission of the solid solution in ZrC is adversely affected. Plasma thermocouple reactor concepts are discussed. Calculations are being made of various cathode geometries and experiments to provide pertinent information are being considered. The compatibility of $(UC)_{0.3}(ZrC)_{0.7}$ with tungsten and beryllium oxide at high temperature was studied. (For preceding period see LAMS-2364.) (W.D.M.)

8667 NDA-2112-2

Nuclear Development Corp. of America, White Plains, N. Y.

THE PREPARATION AND PROPERTIES OF DISPERSION HARDENED URANIUM POWDER PRODUCTS. Quarterly Technical Report for the Period Ending June 30, 1959. W. Arbiter. July 15, 1959. 18p. Contract AT(30-1)-2301. OTS.

Progress in a program to determine the effects of UO_2 dispersion in U metal on its dimensional stability under thermal cycling conditions is reported. Oxidation experiments using 0.002 in. foils of U were conducted in which information concerning handling techniques and the nature of U oxide films was obtained. A trial hydriding run using Fe–U alloy was completed in which 200- and 100-g batches of the alloy were used. The 100-g sample was incompletely hydrided; however, the 200-g sample was ground and hot pressed in vacuum. A second hydriding run was made using U shot. This process and subsequent conversion to U powder proceeded smoothly. A powder oxidation run was made in which 25 g of the hydrided and decomposed U shot was oxidized to test apparatus modifications aimed at loss prevention. Fabrication of the U–14 wt.% Fe alloy resulted in an unsatisfactory product. Other compacts attained a density equivalent to 90% pure U, which corresponds to approximately 25 wt.% UO_2. (For preceding period see NDA-2112-1.) (J.R.D.)

8668 NMI-2080

Nuclear Metals, Inc., Concord, Mass.

FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report for October 1959. Dec. 10, 1959. 29p. Contract AT(30-1)-1565. OTS.

Experimental work continues on the coextrusion of U–10 wt.% Mo alloy clad with Be. The preparation of alloys and equipment for the determination of swelling of U and U alloys is reported. Work is presented on the development of beta-phase U-base alloys of high creep strength which will be dimensionally stable during irradiation at elevated temperatures. Thermal analysis runs were completed on Be–0.5 at.% Nb, Be–2.5 at.% Nb, Be–1 at.% Ni, and Be–5 at.% Ni alloys. Work in the Be fracture program was concerned with mechanical tests on solution-treated and aged polycrystalline Be, tensile testing of single crystals, and experiments on the kinetics of the aging process. The isotopic exchange reactions between U isotopes in reactor fuel dispersions are being investigated. The deformation mechanisms of UO_2 are being investigated. (W.L.H.)

8669 NMI-9602

Nuclear Metals, Inc., Concord, Mass.

DEVELOPMENT OF RANDOMLY ORIENTED WROUGHT BERYLLIUM SHEET. Quarterly Report No. 1. F. M. Yans, A. K. Wolff, and A. R. Kaufmann. Feb. 8, 1960. 52p. Contract AF33(616)-6616.

A program was initiated with the aim of producing randomly oriented beryllium sheet. Rolling experiments are being conducted with billets of hot-pressed polycrystalline material. The variables being studied include rolling and annealing temperatures, per pass and total per cent reductions, and the effect of specimen geometry on deformation. In anticipation of considerable x-ray work, the effect of specimen thickness on x-ray intensity is being studied. Single crystals have been obtained by vacuum casting lump beryllium and carefully cutting the individual crystals from the parent ingot. A Unitron Vacuum Heating Stage and a Hurlbut Counter have been adapted for use with a Bausch and Lomb research metallograph for determination of recrystallization kinetics and study of twin absorption. (auth)

8670 NOR-59-353

Nuclear Metals, Inc., Concord, Mass.

PROGRAM FOR THE DEVELOPMENT OF EXTRUDED BERYLLIUM SHAPES. Interim Engineering Report No. 4 [for] March 1, 1959 through May 31, 1959. 20p. For Northrop Corp. Contract AF33(600)-36931. (AD-218609).

A portion of the total effort of Phase I of the Beryllium Extrusion Development Program is summarized. The portion of Phase I covered by this report includes the mechanical property testing of beryllium extrusions. The feasibility of producing bare extruded beryllium shapes was conclusively proven. (auth)

8671 NYO-4806

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

KINETICS OF REACTIONS BETWEEN LIQUID METALS AND LIQUID SALTS. Progress Report Covering Period March 1, 1959 to December 15, 1959. Thomas B. King. 23p. Contract AT(30-1)-1985. OTS.

The reaction kinetics at high temperatures between two liquid phases, one consisting of a metallic alloy and the other of a molten salt, either halide or oxide, were investigated. The investigation was designed to obtain information of general rather than specific, applicability. The experimental program is divided into five parts: study of convection conditions in a model system; direct rate measurements for transport controlled reactions under constant convection conditions; direct rate measurements for reactions controlled by the phase boundary reaction; electrolytic polarization measurements; and measurements of diffusion coefficients in liquid alloys and salts. (W.L.H.)

8672 OOR-1920-1

California Inst. of Tech., Pasadena.

METALLURGICAL APPLICATIONS OF ELECTRON PROBE ANALYSIS. Interim Technical Report No. 6 [on] THE DESIGN AND DEVELOPMENT OF AN ELECTRONIC X-RAY PROBE FOR THE STUDY OF ALLOYS AND OF THE STRUCTURE OF METALS. David B. Wittry. Dec. 1959. 21p. DA Project No. 5B99-01-004. Contract DA-04-495-Ord-1076.

Problems in the areas of physical metallurgy which have been studied with a microanalyzer are described. (auth)

8673 ORNL-1727(Del. 2)

Oak Ridge National Lab., Tenn.

METALLURGY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING APRIL 10, 1954. W. H. Bridges, ed. Aug. 4, 1954. Decl. with deletions Dec. 1, 1959. 120p. Contract W-7405-eng-26. OTS.

Transformation kinetics studies were started on Ag–Zr alloys. Tensile properties of Th alloys with additions of 2 and 4% Ti and varying C content were determined. The production of U–Al alloys by reduction of UO_2F_2 in a cryolite slag was demonstrated. Dynamic corrosion experiments including impact tests on commercial-purity titanium samples exposed to oxygen-pressurized UO_2SO_4 for periods in excess of 500 hr indicated that no change in impact behavior occurred. Similar tests on Zircaloy 2 gave like results. Corrosion tests on stress relieved stainless steel weld specimens indicated a generally superior corrosion resistance of welds that had been heated to 1000°F for 6 hr compared with as-welded specimens. Data on behavior of materials suitable for bearings and hard facings in molten fluorides are given. Materials tested in contact with liquid lead include alloys such as 25% Mo–75% Ni, 2% Si–14% Cr–84% Fe, Hastelloy B, Ti, Co, Be, and 13% Cr–87% Fe. Studies are in progress on the mass transfer characteristics of various structural metals in contact with fused hydroxides. Evaluation of materials for brazing alloys was continued on the Ni–P eutectic along with studies on other brazing alloys such as Ni–Ge, and Ni–Cr. Data on the stress rupture of sheet Inconel specimens in molten fluoride salts and argon at 1300 to 1600°F are presented. A program was initiated to develop and produce stainless steel fuel and control-rod components for long-time service in 10-Mw package power reactor plants. Sintered fuel-core compacts containing 34 wt.% UO_2, 65.5% stainless steel, and 0.5% B_4C were prepared and encased in stainless steel at 1225°C, thus demonstrating the fabrication feasibility. Petrographic investigations in support of the ANP fuel program continue. In the study of IVA element alloys new phase diagrams are reported for the systems Ag-Zr, In-Zr, Pb-Zr, and Sb-Zr. Results of new determinations show the $\alpha \rightarrow \beta$ transition at 870 ± 3°C. (For preceding period see ORNL-1625.) (J.R.D.)

8674 ORNL-1944

Oak Ridge National Lab., Tenn.

SOLID STATE DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1955. Nov. 16, 1955. Decl. Oct. 22, 1959. 36p. Contract W-7405-eng-26. OTS.

The pressurized stress-corrosion apparatus which is to be inserted in the LITR is shown. The LITR fuel loop was operated for 645 hours with the reactor at full power in order to study the effect of neutron irradiation on the corrosion and fuel stability in a dynamic system. A summary of analyses of fuel samples from the loop is given, and corrosion specimens are shown. The deposition of Ru^{103} and Nb^{95} on the Inconel walls of the LITR loop is discussed. A theoretical study was made of the kinetics of Xe^{135} poisoning. The use of traps to hold back noble gases in a fission-product off-gas line is discussed. Experimental runs with Kr^{85} were made. Sections of an MTR fuel element which had failed in operation are shown. The remote metallographic facility is also shown, as is the ultrasonic specimen cleaner. (W.L.H.)

8675 ORNL-2243

Oak Ridge National Lab., Tenn.

ELECTROLESS-PLATED BRAZING ALLOYS. P. Patriarca, G. M. Slaughter, and W. D. Manly. Mar. 19, 1957. 13p. Contract W-7405-eng-26. OTS.

The electroless-plating process deposits an Ni-P brazing alloy that exhibits excellent wetability and flowability in conjunction with such high-temperature alloys as austenitic

stainless steels or Inconel when heated above the eutectic temperature in a dry hydrogen atmosphere. Complex tube-to-fin heat exchanger assemblies can be fabricated by preplating with electroless Ni-P alloy and then brazing at 1800°F in dry hydrogen. Electroless Ni-P brazed type 316 stainless steel and Inconel joints exhibit favorable oxidation resistance after exposure to air at temperatures up to 1500°F for extended periods of time. Electroless Ni-P brazed type 316 stainless steel joints exhibit poor corrosion resistance to sodium when exposed at 1500°F for 100 hr. The addition of chromium to the Ni-P brazing alloy by electrodeposition provides a means for ensuring excellent oxidation resistance of the fillet. The resistance to sodium attack of the electroless Ni-P brazing alloy can be significantly improved by the addition of chromium by electrodeposition. (auth)

8676 ORNL-2839

Oak Ridge National Lab., Tenn.

METALLURGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 1, 1959. Dec. 16, 1959. 352p. Contract W-7405-eng-26. OTS.

Fundamental Metallurgy. Deformation twins were found in single crystals and coarse-grained specimens of high-purity Nb deformed by impact or slow compression at −196°C. An apparent phase transformation was detected in high-purity Ga deformed at 4.2°K. The specific heat of the group IV-A metals and alloys of Zr−In and Zr−Sn were measured from 1.2 to 4.5°K. In the Zr-rich portion of the Zr−Ga phase diagram, the α/β phase boundaries of Zr are depressed by additions of Ga and the β phase decomposes by a eutectoid reaction. The Cd pressures of $\alpha-$ and $\beta-$Zr alloys containing 1 to 11% Cd were measured between 1090 and 1325°K. Crystal structures of several unreported transition-metal fluorides, rare-earth hydrides and nitrides were determined. Progress in the study of phase transitions in β-quenched Zr−Nb alloys aged below the eutectoid temperature is reported. A high-temperature investigation of the order-disorder phase transition of a Cu−31 at.% Au alloy has revealed an intermediate periodic antiphase condition. A previously described x-ray-diffraction technique for the measurement of the thickness and strain of thin oxide films was applied to a series of five Cu_2O films grown on Cu single crystals. A new x-ray-diffraction method for measuring film thickness, based on the integrated intensities of the Bragg maxima, is shown to agree very well with the thickness as determined from the line-shape analysis. A determination was made of the influence which electrostatic interactions with neighboring ions have on the energy $n \rightarrow \pi$ transition in the nitrate ion. Some information on the behavior of solute species in dilute solutions of Bi in $BiCl_3$ was obtained from absorption spectra. Studies of the gaseous oxidation of Nb and Zr in the ORNL Graphite Reactor indicated that neutron fluxes of $\sim 10^{12}$ nv had no effect on the oxidation processes for these two metals. A variety of new techniques was applied to the study of the oxidation of Ta. Efforts to grow macroscopic single crystals of ceramic-type materials were initiated. HRP Metallurgy. An intensive study of the effects of fabrication variables on the anisotropy of mechanical properties and the preferred orientation in Zircaloy-2 is reported. The transformation sequence study of the Zr−Nb−X alloys is reported. A detailed macro- and micro-examination was completed on samples and debris removed from the core vessel of the Homogeneous Reactor. The fabrication of Zircaloy-2 vessels is discussed. Type 312 stainless steel was found to be satisfactory barrier material in making tube-to-header welds in Inconel-type 347 stainless steel composites. Reactor Metallurgy. Examinations were made of low-alloy and stainless steels following their exposure to impurities outgassed by graphite. A three-phase out-of-pile corrosion test program is continuing in order to evaluate the behavior of Inconel and INOR-8 in contact with fluoride salt mixtures in terms of such variables as time, temperature, and flow rate. Inconel and INOR-8 specimens carburized in the Na−graphite system show an appreciable decrease in their room-temperature ductility. The nickel-base Coast Metals Nos. 52 and 53, the 82 Au−Ni, and pure copper brazing alloys show no attack when subjected to fuel 130 for 100 hr at 1300°F. It was found that $LiF-BeF_2-UF_4$ (62-37-1 M %, fuel 130) would precipitate part of its U as UO_2 when in contact with graphite at 1300°F. Graphite grades GT-123, 186, CCN, R-0013, AGOT, and TSF were exposed in 100-hr static permeation tests to molten fluoride salts at 1300°F under a 150-psig pressure. Hot-pressed UO_2 pellets show no corrosion after being subjected to pure lead, pure bismuth, the 55 Bi−45 Pb eutectic alloy, and the Pb−0.69 Li alloy eutectic in separate tests at 650 and 750°F. The reactions of type 304 stainless steel with CO and CO_2 were studied at high temperatures. Studies were made to determine the feasibility of fabricating a triplex heat exchanger tube made up of two concentric tubes separated by a porous metal annulus to enable passage of a gas for leak detection. The diffusion coefficients of Ag and Ni in liquid Pb were measured by the capillary reservoir technique. Work on the eddy-current inspection of tubing is reported. Ultrasonic inspection technique developments are presented. Problems studied in connection with the Experimental Gas-Cooled Reactor include creep buckling, creep burst, and gas-metal reactions. Applied Metallurgy. Metallurgical development in the Army Package Power Reactor (SM-1) Project was confined primarily to problems associated with the burnable poison, boron, which as B_4C is homogeneously distributed in the UO_2−stainless steel fuel core. The Maritime Ship Program continued in support of work associated with construction of the NS "Savannah." Other studies were directed principally to possible advancements in fuel element design. Twenty-four alloy- and dispersion-type irradiation specimens were prepared and irradiated in the MTR. Additional work on UO_2 dispersions in aluminum is reported. Studies have revealed that no great problems exist in incorporating UO_2 in type 430 ferritic stainless steel and rolling into composite plate. The ORR fuel-irradiation program will investigate the effects of exposure temperature and fission burnup on Th-base materials irradiated in temperature-controlled capsules. Corrosion tests of Zr and Zircaloy-2 intergranularly penetrated by Mg at 625°C were continued. The technical feasibility of producing UO_2 fuel bodies by the extrusion process is being investigated. Cursory studies on the chemical reactions of eight different oxides in contact with Nb, Mo, Ta, W, and Re at elevated temperatures are reported. A study of the sintering characteristics of the lanthanide oxides reveal that CeO_2 is the most refractory of the group and is stable toward air and boiling water. X-ray-diffraction work on the $UO_2-Y_2O_3$ system is reported. The linear expansion characteristics of several reactor materials were investigated. (W.L.H.)

8677 ORO-241

Union Carbide Metals Co., Niagara Falls, N. Y.

COLUMBIUM CLAD URANIUM CARBIDE FUEL ELEMENT CONTRACT. Monthly Letter Report [for] November 1 through November 30, 1959. J. J. Finley, Michael Korchynsky, and S. Sarian. 2p. Contract AT(40-1)-2559. OTS.

Experiments in which hydrided U was reacted with methane are reported. The average particle diameter of the

product was 3.1 μ. A trace inclusion of UC_2 was found. In another experiment carbon reduction of the oxide was effected by mixing stoichiometric quantities of U_3O_8 and graphite. Various compositions of U and C were melted in graphite crucibles. In one series, charges were slowly heated in vacuum to 1750°C. The microstructure of the resulting slags contained large amounts of free U, surrounding the dendritic globular crystals of UC. A second melt was conducted at 2650°C for ½ hr in vacuum. Metallographic examination revealed primarily UC_2 structures with a large amount of free graphite. Modification to existing equipment and plans for future work are discussed. (J.R.D.)

8678 ORO-244

National Carbon Co., Fostoria, Ohio.

FUEL CYCLE DEVELOPMENT PROGRAM. Quarterly Progress Report [for] May 1, 1959 to August 1, 1959. Sept. 1, 1959. 15p. Contract AT(40-1)-2560. OTS.

Preparation of uranium–graphite fuel elements with dispersions varying from very heterogeneous to homogeneous is reported. About 1600 pellets were formed and are being used to study uranium migration during high-temperature processing. Coating integrity tests with high-voltage discharges were inconclusive. Data on physical properties of the graphite–uranium admixtures are included. (J.R.D.)

8679 TID-3544

Technical Information Service Extension, AEC.

LIQUID METAL TECHNOLOGY. A Literature Search. James M. Jacobs, comp. Jan. 1960. 27p. OTS.

Two hundred seventeen references to unclassified reports and published literature on liquid metal technology are presented. (W.L.H.)

8680 UCRL-9020

California. Univ., Berkeley. Lawrence Radiation Lab.

EPOXY PLASTICS. Joseph W. Bryan and Richard A. Perkins. Dec. 24, 1959. 13p. Contract W-7405-eng-48. OTS.

Practical methods of handling and using some of the many epoxy plastics are discussed. Molds, mold-release agents, fillers, diluents, and modifiers are described. Mixing, pumping, bonding, equipment required, and toxicity are also covered. A collection of formulas is tabulated from which an appropriate type of epoxy mixture may be selected. (auth)

8681 WADC-TR-59-465

North American Aviation, Inc., Downey, Calif.

ELECTRODEPOSITION OF ALUMINUM ON MAGNESIUM. [Period] covered: June 1, 1958 through March 31, 1959. E. W. Cooke and S. Kritzer. July 1959. 30p. Project title: MATERIALS APPLICATIONS. Task title: MATERIALS PRODUCT DEVELOPMENT. Contract AF33(616)-5854. OTS.

Detailed tests made to electrodeposit aluminum directly onto magnesium, using a modification of the nonaqueous bath developed by the National Bureau of Standards, are described. It is shown that good adhesion is not obtained and a reaction occurs between the electroplating solution and magnesium. However, it is indicated that by using a zinc immersion intermediate coating, satisfactory adhesion is obtained. The purity of aluminum deposited in this manner is greater than 99.8%, with low porosity. Good adhesion is also obtained on copper and steel. These coatings can be satisfactorily anodized. (auth)

8682 WASH-123(Del.)

Division of Research, AEC.

URANIUM ALLOY NEWSLETTER, NUMBER 2. David W. Lillie. Apr. 1953. Decl. with deletions Dec. 1, 1959. 47p. OTS.

A review of activities among A.E.C. contractors on uranium alloys is presented. Data on twenty-nine alloys are included. (J.R.D.)

8683 NP-tr-332

PROBLEMS OF POWDER METALLURGY AND THE STRENGTH OF MATERIALS. (Voprosy Poroshkovoy Metallurgii i Prochnosti Materialov). Translated from a publication of the Academy of Sciences of the Ukrainian S.S.R., Kiev, 1958. 272p. OTS.

Thirteen papers are presented on various problems in powder metallurgy. The subjects include physical properties of various compounds, phase diagrams of Cr–Nb alloy, determination of temperature, sintering metallic powders, properties of chromium carbide, pulverization of titanium carbide, and mechanical properties of heat-resistant materials. (W.L.H.)

Corrosion

8684 CRMet-859

Atomic Energy of Canada Ltd., Chalk River, Ont.

CORROSION BEHAVIOR OF ALUMINUM–NICKEL–IRON ALLOYS IN HIGH-TEMPERATURE WATER: EFFECT OF DISSOLVED SILICA AS AN INHIBITOR. G. J. Biefer and P. G. Anderson. Aug. 1959. 44p. (AECL-882). AECL.

In static tests of 500 to 800 hours on aluminum-nickel-iron alloys in water containing 120 to 1000 ppm dissolved SiO_2, corrosion penetrations were found to be ⅙ to ⅓ those observed in deionized water at the same temperature. At 300°C the corrosion rate was independent of pH in the range 6 to 7, whereas at 260°C the corrosion rate at pH6 was $\frac{1}{10}$ the rate at pH7. Low corrosion rates were associated with the formation of a montmorillonite ($Al_2O_3 \cdot 4SiO_2 \cdot H_2O \cdot nH_2O$) corrosion film. In dynamic tests at low ratios of specimen area to loop volume, general corrosion rates of 5 to 10×10^{-3} inches/year were observed in runs at 260°C and 20 feet/sec velocity in water containing 700 to 900 ppm silicate, i.e., $\frac{1}{10}$ to ⅓ of the rate observed in deionized water. Severe pitting was observed in these dynamic tests. (auth)

8685 CT-3023

Chicago. Univ. Metallurgical Lab.

CORROSION OF CONSTRUCTION MATERIALS, BONDING MATERIALS, AND URANIUM—AN ELECTROCHEMICAL INVESTIGATION. R. B. Hoxeng. May 2, 1945. Decl. Jan. 28, 1960. 70p. Contract W-7401-eng-37. OTS.

A study was made of the effect of solution composition on the galvanic corrosion of the (72S)2S Al couple. Equipment is described which was used to obtain electrochemical information. Results are presented graphically. Preliminary studies of bonding materials showed that Sn–Zn solders of certain compositions could be heat treated so as to retain enough Zn in solid solution to have a solution potential cathodic to Al. Solution potentials between different portions of a pitted U specimen may be as high as one volt and are probably an important factor in the corrosion of U. (W.L.H.)

8686 CT-3047

Chicago. Univ. Metallurgical Lab.

CORROSION OF UNBONDED ALUMINUM-JACKETED SLUGS IN AQUEOUS MEDIUM. Report on a Phase of Problem No. 391-ML-53-4; File Serial No. 22. G. C. English and J. E. Draley. Jan. 30, 1945. Decl. Jan. 28, 1960. 15p. Contract W-7401-eng-37. OTS.

Leaky jacketed tuballoy slugs had been observed to fail rapidly in water by formation of areas of local swelling or

"pimples." In a production plant, this would result in severe operational difficulties. The present study was undertaken in an effort to understand the phenomena of pimple formation. In corrosion tests on pinholed unbonded tuballoy slugs jacketed with 2S aluminum cans, two types of attack were noticed: (1) general swelling over the surface of the slug and (2) pimple formation. The rate of attack producing general swelling at temperatures from 45 to 90°C was of the same magnitude as the corrosion rate of bare tuballoy in hydrogen saturated water, causing diameter increases at rates of 0.24, 1.0, and about 5.5 mils/day at 45, 70, and 90°C, respectively, where one pinhole was drilled in each can. The attack leading to pimple formation was much more rapid than that producing general swelling, and was the result of a reaction which produced tuballoy hydride. The source of the hydrogen was the aqueous corrosion which produced the general swelling. Analysis indicated enough hydrogen in the pimple material to account for a large percentage of its total weight as TuH_3. The time required for the formation of pimples over 80 mils high showed considerable variation, but averaged about 4 days, 13 days and greater than 50 days, for temperatures of 90, 70, and 45°, respectively. The free access of water between the can and the slug in the region near a pinhole prevented pimple formation in that region. (auth)

8687 CT-3057
Chicago. Univ. Metallurgical Lab.
CORROSION RESEARCH—THE SEALING OF CRACKS IN ALUMINUM SURFACES. J. E. Draley and G. C. English. Oct. 19, 1944. Decl. Jan. 28, 1960. 9p. Contract W-7401-eng-37. OTS.

The changes in surface dimensions of 2S Al under simulated reactor operating conditions were investigated. Results were inconclusive on the sealing of surface cracks of Al by oxide formation. (W.L.H.)

8688 DP-416
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
CORROSION OF CARBON STEEL IN WASTE SOLUTIONS CONTAINING MERCURY. Patricia M. Kranzlein. Nov. 1959. 12p. Contract AT(07-2)-1. OTS.

The corrosion behavior of A-285, A-135, A-106, and A-53 carbon steel was studied in multicomponent simulated waste solutions containing mercury. In the liquid phase, the carbon steels corroded at a very low rate; mercury did not increase the corrosion rate in any of the solutions tested. In the vapor phase and at the vapor-liquid interface, pitting occurred; the pitting was independent of solution composition, and was caused mainly by the condensation of oxygenated water from the aqueous wastes. (auth)

8689 WADC-TR-57-542.
Thiokol Chemical Corp. Reaction Motors Div., Denville, N. J.
A STUDY OF THE CORROSIVE EFFECTS OF THE COMBUSTION PRODUCTS OF BORON CONTAINING FUELS ON SELECTED HIGH TEMPERATURE MATERIALS. [Period] covered: July 1956 to May 1958. Frank J. Loprest and Steven J. Tunkel. May 20, 1958. 305p. Project title: AVIATION FUELS. Task title: HIGH ENERGY FUEL MATERIALS AND PROPERTIES. Contract AF33(616)3713. OTS.

A method is presented for treating in a quantitative manner the corrosion data obtained, as is a rating of all the alloys tested. The data show that for all alloys there exists a critical temperature (T_c) in the range 1600 to 2000°F above which the corrosion rate increases very rapidly with increasing temperature, and above which serious pitting, and even destruction, occurs within 150 hours. The rate of corrosion below T_c was determined. A characteristic value, A, representing this rate is listed for many alloys and tentatively related to the elemental composition. The effect of combustion velocity products on the corrosion processes discussed, and mechanisms of the process are presented. Data on the cleaning of deposited boric oxide by saturated steam are also included. (auth)

8690 WASH-733(p.185-208)
Argonne National Lab., Lemont, Ill.
CHARACTERISTICS OF ZIRCONIUM CORROSION. R. D. Misch. 24p.

The mechanisms of Zr corrosion are discussed. The restrictions which corrosion imposes on Zr fabrication are presented. (W.L.H.)

8691
CORROSION RESISTANCE OF URANIUM-BASE ALLOYS. II. EXPERIMENTS WITH CLAD ALLOYS. M. J. Brabers. Atoomenergie 2, 17-20(1960) Jan. (In Dutch)

A comparison was made of the corrosion and radiation resistance of U–Mo, U–Nb, U–Mo–Nb, and U_3Si. The U with 9 to 13.5% Mo and 10% Nb was suitable as a fuel up to 340°C. The maximum burnup of this alloy is determined by its volume increase during fission. (T.R.H.)

8692
CORROSION CRACKING OF LOW-CARBON STAINLESS STEEL. B. V. Linchevskii and V. V. Romanov (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 129, 1020-3(1959) Dec. 11. (In Russian)

Studies were made of corrosion, mechanical properties, and corrosion cracking of low-carbon stainless steel 1 X 18H9 (0.10%C). It was found that variations of carbon concentration from 0.1 to 0.014% do not affect the resistance to corrosion cracking in 42% boiling solution of $MgCl_2$. (R.V.J.)

Fabrication

8693 AD-213913
Beryllium Corp., Reading, Penna.
BERYLLIUM CASTING. PHASE II. [Period covered]: November 19, 1958–March 18, 1959. Paul M. Cohen. 24p. Project No. 7-643. Contract AF33(600)-37902.

Completion of the induction melting phase of the melting study was completed. Heat records and data on chemical analyses of the heats are included along with macrographs of sample ingot induction furnace diagrams. (J.R.D.)

8694 AD-215613
Brush Beryllium Co., Cleveland.
FABRICATION OF BERYLLIUM WIRE. Progress Report No. 2 [for] December 16, 1958 to February 15, 1959. A. G. Gross, Jr., R. G. O'Rourke, and W. W. Beaver. 15p. Contract NOas-59-6030-C.

Progress in true-stress–true-strain testing is reported. It is estimated that 35% area reduction at 850°F by wire drawing may be made between stress-relieving treatments. Preliminary investigation of cold compacting of canned powder followed by warm extruding to draw stock was carried out. It was found that a critical compact green density exists which limits the swaging point. Initial drawing experiments at 850°F were made. These indicate that large reductions in area per pass are more desirable than light reductions from the standpoints of surface and lubrication. (For preceding period see AD-210451.) (J.R.D.)

8695 AD-215774

National Lead Co. Doehler-Jarvis Div., Toledo.

ULTRA HIGH PRESSURE CASTING. Interim Report No. 2 [Covering Period] March 1, 1959 to May 30, 1959. E. C. Kron and J. L. Reiss. 35p. ASC Project No. 7-646. Contract AF33(600)-28165.

In the past three months, 34 of the 40 casting conditions outlined for this project were produced. A large portion of these casting conditions have been tested for mechanical properties, x-ray macrostructure, and density. Vacuum degassing 356 alloy materially increased the tensile and yield strengths of the 356-T6 alloy from 37,000 to 42,800 and from 29,100 to 35,500 psi, respectively. Casting the vacuum degassed alloy at pressures of 50,000 psi or more resulted in excellent ductility without sacrificing strength. The per cent elongation was increased from 4 to 5% to 10 to 18%. The increase in ductility as a result of pressure applied during casting is obtained even when the pressure is applied after most of the cast metal has solidified. The time pressure is applied after pouring does not appear to be critical. All x-ray, macroetch, and density tests of castings cast with a pressure of 50,000 and 100,000 psi showed flawless, dense, and sound structures. Casting pressures of 50,000 psi for the casting method used, is equally as effective as 100,000 psi pressure. For the casting methods used, casting pressures of 10,000 and 20,000 psi resulted in castings with such numerous large defects that reliable mechanical properties were not obtainable. (auth)

8696 AECU-4695

Stevens Inst. of Tech., Hoboken, N. J.

PROGRESS LETTER NO. 11 [FOR] JANUARY 1, 1960 THROUGH JANUARY 31, 1960. Edward H. Baron. Feb. 15, 1960. 5p. Contract AT(30-1)2258. OTS.

A stainless steel autoclave for superheated water corrosion tests was installed and conditioned. Tests were begun to investigate the feasibility of densifying slip cast stainless by means of liquid phase sintering. The liquid phase is induced by additions of Nicrobraze stainless steel brazing powder. Nicrobraze powder was sprinkled on the surface of a green specimen and sintered at 1250°C for a half hour. Metallographic examination revealed that the resulting plate was completely dense. Tests on stainless steel bars at 1175°C revealed no effect of the Nicrobraze powder, but at 1225°C, a slight increase in density was effected by each incremental Nicrobraze powder addition. Preparation of tubular fuel elements by vacuum forming was resumed. Uniform, smooth surfaced castings were obtained from a slip thickened with acrysol GS and formed on 0.1 μ thimbles. Castings vacuum formed from slips thickened with acrysol GS were sintered on alundum mandrels for a half hour at 1175°C, and for one hour at 1175°C preceded by a half hour pre-heat at the low temperature end of the hot zone. In both tests cracks developed parallel to the axis of the mandrel. (See also AECU-4410.) (C.J.G.)

8697 BRB-3

Bridgeport Brass Co., Conn.

EXTRUSION OF URANIUM FOR HANFORD CORED SLUG PROGRAM. [PART] I. R. M. Treco, G. T. Murray, and H. S. Rubenstein. Dec. 27, 1954. Decl. Jan. 28, 1960. 67p. Contract AT(30-1)-1405. OTS.

The results of mandrel-tip extrusion experiments for producing tubular fuel elements as small as $\frac{1}{4}$ in. are presented. Alpha-extrusion of bare U using a chloride salt for heating and extrusion lubrication was found to be an acceptable method. (J.E.D.)

8698 CT-2751

[Chicago. Univ. Metallurgical Lab.].

VACUUM CASTING OF ALUMINUM–SILICON COATING ON TUBALLOY [URANIUM]. Final Report on a part of P.A. No. 390-ML-54-S, F.S. 17. D. L. Schwartz and L. Kurland. Mar. 23, 1945. Decl. Jan. 29, 1960. 27p. Contract W-7401-eng-37. OTS.

8699 DMIC-122

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

THE WELDING OF TITANIUM AND TITANIUM ALLOYS. G. E. Faulkner and C. B. Voldrich. Dec. 31, 1959. 70p. Contract AF18(600)-1375. (PB-151079). OTS.

Welding is used to fabricate titanium and titanium-alloy components for air-frames, jet engines, missiles, and chemical equipment. Among the most important considerations in adapting titanium and its alloys to welded components is to use proper welding procedures and to select alloys that have the required weld-joint properties. The chemical and metallurgical characteristics that affect the selection of welding processes and alloys are discussed. Also, information is presented on surface preparation, welding procedures, and quality control. In addition, detailed data on the mechanical properties of welded joints in the commercial grades of titanium and titanium alloys and how these properties are affected by heat treatment and elevated temperatures are presented. (auth)

8700 HW-33419

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ZIRCONIUM CLADDING OF URANIUM. P. J. Pankaskie and L. D. Schaffer. Nov. 1, 1954. Decl. Jan. 29, 1960. 27p. Contract W-31-109-Eng-52. OTS.

Under proper conditions of vacuum and mold preheat, a sound ductile alloy bond can be achieved by casting molten uranium into zirconium and Zircaloy-2 molds. Investigations indicate that a process for production of zirconium of Zircaloy-2 clad fuel elements can be developed by casting directly into preformed shells. Employment of cast bonding techniques appears to be a simple and practical method for assembling extrusion billets. It also appears that co-extrusion of cast bonded normal uranium billets produces a clad rod exhibiting a rather uniform cladding thickness and may permit greater freedom in selection of extrusion conditions to produce a clad and bonded geometry. Forming of cast bond ingots in diamond-round or oval-round sequences failed to produce a clad rod with uniform jacket thickness. Subsequent forming operations failed to rectify non-uniformities in jacket thicknesses once they had occurred. (auth)

8701 HW-33849

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRELIMINARY INVESTIGATION OF THE UNISKAN PROCESS FOR THE EXTRUSION OR SIZING OF TUBULAR SECTIONS. A. T. Taylor. Nov. 22, 1954. Decl. Jan. 29, 1960. 36p. Contract W-31-109-Eng-52. OTS.

The Uniskan process of metal working is a type of roll forming process suitable for the fabrication of thin walled shells or tubing. Uniskanning is unique in that high unit compressive forces are brought to bear on the metal specimen by three forming rolls spaced approximately 120° apart on the same horizontal plane with axes parallel to the axis of rotation of the specimen which is translated in a direction parallel to the axes of the rolls. The process is capable of producing thin tubular sections, 0.001 to

0.020 in. wall thickness, from comparatively heavy wall cups or sleeves, in a variety of metals including Al, mild steel, Ni, and Zr. Reductions approaching 90% were made in one pass on Zr, and a 20% one pass reduction, was made on U. The mechanical properties of the materials are comparable to those produced by other cold-working processes and the relations between the tensile strengths of Zr, Ni, and Al and the percentages of reduction are shown. Present development is directed towards the one step fabrication from thick wall cups of 0.20 in. wall Zr cans suitable for cast-bonded fuel elements and the fabrication of the thin tubular sleeves. The process has potential application also as a means of sizing an Al can onto a U core to produce a cold-canned fuel element. Statistical analyses of the mechanical properties and variables in the process are planned. (auth)

8702 KAPL-M-WAO-4

Knolls Atomic Power Lab., Schenectady, N. Y.

A STUDY OF THE HARDNESS OF SEVERAL USMC INCONEL TUBE WELDS. W. A. Owczarski. Jan. 1960. 14p. OTS.

An investigation was conducted to determine if spontaneous hardening took place in a series of welded tube joints made with INCO-weld A wire causing failure in bend tests. Summaries of bend test data are given along with results of metallographic examinations and hardness surveys. It was concluded that the failures of bend specimens were due to excessive fissuring not associated with hardness. (J.R.D.)

8703 NAI-59-101

Beryllium Corp., Reading, Penna. and Nuclear Metals, Inc., Concord, Mass.

PROGRAM FOR THE DEVELOPMENT OF EXTRUDED BERYLLIUM SHAPES. Interim Engineering Report No. 2 [for] September 1, 1958–November 30, 1958. 44p. For Northrop Aircraft, Inc. Contract AF33(600)-36931. (AD-213516).

A portion of the total effort of Phase I of the Beryllium Extrusion Development Program is summarized. This work includes the development of experimental tooling, beryllium extrusion billet procurement or preparation, beryllium extrusion lubrication criteria, and production of developmental extruded beryllium rod. (auth)

8704 NDA-2112-4

Nuclear Development Corp. of America, White Plains, N. Y.

THE PREPARATION AND PROPERTIES OF DISPERSION HARDENED URANIUM POWDER PRODUCTS. Quarterly Technical Report for the Period Ending September 30, 1959. W. Arbiter. Oct. 15, 1959. 31p. Contract AT(30-1)-2303. OTS.

Studies of the effect of UO_2 dispersions in uranium metal upon properties which exhibit resistance to radiation damage were continued. Procedures were developed for preparing uranium powders of particle size less than 5 μ by hydride decomposition, and methods were developed for controlled oxidation of the powders obtained. Equipment for vacuum hot pressing and/or extrusion of powders was designed and fabricated. Samples of dispersion-hardened uranium, containing 13 to 33 vol.% uranium oxide, were prepared by extrusion in the gamma uranium temperature range. These samples were subjected to thermal cycling tests through the $\alpha-\beta$ transformation temperature using a total cycle time of 15 to 20 min. Dimensional stability was observed to be superior to that of wrought, unalloyed uranium. Transverse bending tests revealed the high-temperature strength of the dispersion-hardened compositions to be substantially greater than that of wrought, unalloyed uranium. (For preceding period see NDA-2112-1.) (C.J.G.)

8705 NOR-60-14

Northrop Aircraft, Inc., Hawthorne, Calif.

PROGRAM FOR THE DEVELOPMENT OF EXTRUDED BERYLLIUM SHAPES. Interim Engineering Report No. 6 [for] September 1, 1959 through November 30, 1959. 20p. Contract AF33(600)-36931.

A portion of the total effort of the Beryllium Extrusion Development Program, Phase I, is summarized. The work reported is part of an extension to Phase I in which the major problems of beryllium extrusions are being thoroughly investigated. Feasibility of unclad beryllium extrusion was demonstrated; however, additional work was considered necessary to perfect extrusion methods. Twenty linear foot lengths of extruded shapes are desired. Ten to twelve foot lengths have now been realized, and efforts are now being directed toward method development for the twenty-foot long Phase I channel shaped extrusions. (auth)

8706 NP-8340

Aeroprojects, Inc., West Chester, Penna.

FUNDAMENTALS OF ULTRASONIC WELDING. PHASE II. Bimonthly Progress Report No. 4 for June 16 to August 15, 1959. Aug. 31, 1959. 28p. Contract NOas 59-6070-c.

The stress distributions across the interfacial weld plane and across a parallel plane near the welding tip are presented graphically for loaded models. The data involved a study of the frictional properties of the photoelastic materials used. Precise data on acoustical power required for welding aluminum, silver, tantalum, and zirconium are being obtained. Tests on nickel and type 302 stainless steel, and 1100-H18 and 1100-0 aluminum alloys showed that more electrical power was required to weld the original "as-received" material than the annealed. Improved techniques for establishing energy losses to the anvil are being developed. (auth)

8707 ORO-246

Clevite Research Center, Cleveland.

MONTHLY PROGRESS REPORT NO. 7 [FOR] PERIOD DECEMBER 1, 1959 TO DECEMBER 31, 1959. R. H. Baskey. Jan. 7, 1960. 3p. Contract AT(40-1)-2557. OTS.

Compacts of as-drawn aluminum-coated fiberglas produced by a two-step pressing operation exhibited a density of 2.61 g/cm^3 (99.1% of theoretical). Several of these compacts were clad and hot rolled to a plate thickness of 0.05 in. No edge cracking was evident in these specimens and microscopic examination revealed a fairly even thickness throughout. Analysis of depleted uranium-bearing aluminum-coated fiberglas was made for aluminum and U_3O_8 content. The data are to be used in the calculation of core section dimensions for standard fuel plates. (For preceding period see ORO-226.) (J.R.D.)

8708 ORO-247

Clevite Research Center, Cleveland.

MONTHLY PROGRESS REPORT NO. 8 [FOR] PERIOD JANUARY 1, 1960 TO JANUARY 31, 1960. R. H. Baskey. Feb. 12, 1960. 4p. Contract AT(40-1)-2557. OTS.

In development of aluminum-coated fuel bearing fiberglas cores, densities of hot-pressed material were increased to 2.59 g/cm^3. The first shipment of depleted uranium-bearing fiberglas contained more urania glass than was needed to produce a standard size MTR core section. Correction by core thickness reduction is planned. Drawing operation to demonstrate feasibility of drawing and coating enriched U_3O_8 was not successful due to formation of crystalline particles in the glass. In a program to evaluate the

effects of fiber distribution on the tensile strength of fiberglas-reinforced aluminum, a series of specimens were machined from as-hot pressed composites. One group of specimens was taken longitudinal to the fiber direction while the other group was taken transverse to the fiber direction. The specimens taken longitudinal to the fiber direction displayed better properties than the transverse specimens; the tensile strengths were greater at all temperatures and specimens retained their strengths at 250 to 600°F. The as-pressed tensile specimens taken transverse to the fiber direction showed tensile strengths of 16,700 psi at room temperature to 4,560 psi at 600°F. A series of experiments involving fabricated material is underway to evaluate the tensile strengths of specimens taken transverse to the rolling direction with fibers parallel to the direction of the applied tensile stress. (For preceding period see ORO-246.) (J.R.D.)

8709 ORO-248

Carborundum Co., Niagara Falls, N. Y.

SYNTHESIS AND FABRICATION OF REFRACTORY URANIUM COMPOUNDS. Quarterly Report No. 2 [Covering Period] September 1 to November 30, 1959. K. M. Taylor, C. A. Lenie, P. A. Smudski, L. N. Hailey, and T. J. Keaty. Dec. 14, 1959. 21p. Contract AF(40-1)-2558. OTS.

Good quality uranium mononitride, UN, was synthesized by nitriding uranium metal powder and by nitriding a stoichiometric mix of UO_2 and carbon. In the preparation of UN, it was unnecessary to decompose the higher nitrides in vacuum. The mononitride is obtained by nitriding at about 1400°C, followed by cooling in an inert atmosphere such as argon. High quality UC was prepared by the carbon reduction of UO_2. Pellets having a density of 12.0 grams per cubic centimeter were made by milling this powder to a particle size of 0.5 to 1 μ, then cold pressing and sintering. A single pellet having a density of 13.3 grams per cubic centimeter (about 97% of theoretical) was made by simultaneously reacting and hot pressing a stoichiometric mix of uranium metal powder and carbon. Experiments on the preparation of both UN and UC by the carbon reduction of ammonium diuranate are continuing. U_3Si_2 was synthesized by quenching melts of uranium and silicon from about 1700°C. Studies indicate that U_3Si_2 can be prepared by hot pressing a stoichiometric mix of the elements and omitting the quenching step, if certain materials such as aluminum nitride are used as dies instead of graphite. (For preceding period see ORO-221.) (auth)

8710 ORO-251

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

MONTHLY LETTER REPORT NO. 14 COVERING PERIOD DECEMBER 15, 1959 TO JANUARY 15, 1960. J. D. Fleming. Jan. 25, 1960. 3p. Project No. B-153. Contract AT(40-1)-2483. OTS.

Fabrication of differential thermal analysis pellets of beryllium–uranium dioxide was begun, using water as a lubricant. Tensile tests were continued using small diameter specimens at 1000, 1500, and 2000°F. An increase in strength with temperature was noted in all cases. Room temperature tensile tests were carried out to determine the influence of firing conditions on strength. Work was begun on adaptation of the graphite mold release to an aqueous system. A statistical study of fabrication variables considered relative to the mold, the slip, and the firing conditions including temperature and time was completed. (See also ORO-225.) (C.J.G.)

8711 WASH-733

Division of Reactor Development, AEC.

MINUTES OF THE SIXTH ANNUAL AEC WELDING COMMITTEE MEETING, OAK RIDGE NATIONAL LABORATORY, SEPTEMBER 25-26, 1956. Apr. 1957. Decl. Nov. 23, 1959. (Issued in two parts: (Pt. 1), 210p. and (Pt. 2), 276p.) OTS.

Nine papers are presented. Separate abstracts have been prepared for each paper. (W.L.H.)

8712 WASH-733(p.20-69)

International Nickel Co., Inc. [Development and Research Div.], New York.

A STATISTICAL STUDY RELATING CRACKING TENDENCY AND COMPOSITION OF FULLY AUSTENITIC TYPE 347 WELD METAL. V. N. Krivobok. 50p.

The cracking tendency of full austenitic Type 347 weld metal was investigated. Carbon and manganese are shown to be the most potent elements in reducing cracking, and phosphorus and sulfur are the strongest and most definite crack promoters. Silicon appears to have less effect in promoting cracking than was thought, heretofore. The composition of the base material as well as the electrode was considered in calculating the weld bead chemistry which was used in the statistical study. All electrodes used in the tests employed a line-type covering. (W.L.H.)

8713 WASH-733(p.70-111)

Public Service Electric and Gas Co. Electric Engineering Dept., Newark, N. J. and International Nickel Co., Inc. Development and Research Div., New York.

THE ROLE OF DUCTILITY AS RELATED TO SERVICE PERFORMANCE OF HEAVY WALL AUSTENITIC STEEL PIPE WELDS. Henry M. Soldan and Charles R. Mayne. 42p.

The results are correlated of the newly developed Rensselaer Polytechnic Institute hot ductility tests with the fabrication and service performance of austenitic steel piping in high-temperature central station service, and it is foreseen that these tests, performed on initial ingots or blooms, may eventually become a part of applicable piping material specifications. They show that in the meantime welds in highly restrained thick wall piping, which have been difficult to make because of poor hot ductility of the parent metal, have been successfully made with the new Croloy 16-8-2 electrodes, which fact is attributed to the relief of residual welding stresses by the higher ductility of this weld metal. (auth)

8714 WASH-733(p.112-64)

McKay Co., York, Penna.

PROPERTIES OF AUSTENITIC CHROMIUM MANGANESE STAINLESS STEEL WELD METAL. H. F. Reid, Jr. and W. T. DeLong. 53p.

A study was undertaken to compare Cr–Mn stainless steel weld metal properties with conventional Cr–Ni weld deposits. These comparisons make it possible to appraise the potentialities of these new materials. Certain composition limits governing their properties were established. Properties of more than 100 specific Cr–Mn–Ni weld deposits evaluated in the course of this study are summarized. (W.L.H.)

8715 WASH-733(p.165-84)

Argonne National Lab., Lemont, Ill.

WELDING OF EBWR FUEL SUBASSEMBLIES. C. C. Stone, R. A. Noland, F. D. McCuaig, and D. E. Walker. 20p.

An inert-gas tungsten-arc spot welding process was found suitable for the requirements of fabricating fuel subassemblies for EBWR. (W.L.H.)

8716 WASH-733(p.209-35)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

WELDING AND FABRICATION PROBLEMS IN THE DE-

VELOPMENT OF PWR TYPE FUEL ELEMENT AND CORE COMPONENTS. A. H. Kasberg. 27p.

The welding equipment used for the welding of PWR fuel rods and fuel rod bundles is described along with the principles of welding Zircaloy-2. (W.L.H.)

8717 WASH-733(p.332-62)
Aeroprojects, Inc., West Chester, Penna.
PROGRESS REPORT ON ULTRASONIC WELDING.
J. Bryon Jones. 31p.

Ultrasonic welding is a method for bonding similar or dissimilar metals by the introduction of ultrasonic energy into the metals in the area to be joined. Progress in the development of continuous and spot-type ultrasonic welding is discussed. The present utility and future potential of ultrasonic welding are also discussed. (W.L.H.)

8718 WASH-733(p.453-76)
Oak Ridge National Lab., Tenn.
WELDING TANTALUM AND COLUMBIUM. 24p.

Tantalum and niobium have similar physical and chemical properties, and similar conditions must be established for producing welds. Three methods were successfully applied: resistance welding, submerged arc welding, and inert gas arc welding. (W.L.H.)

8719
IMPROVEMENTS IN OR RELATING TO METHODS FOR CAESIUM DEPOSITION. Edward Percival Butt (to United Kingdom Atomic Energy Authority). British Patent 828,005. Feb. 10, 1960.

A method of depositing Cs on photocathodes or other surfaces is described. A Zr filament takes up Cs vapor and retains it when cooled. The filament is then disposed as desired with relation to the surface to be coated with Cs. Upon reheating, the Cs vapor escapes from the Zr filament and is deposited on the surface. An apparatus for carrying out these operations is described. (T.R.H.)

Properties and Structure

8720 AD-214093
Westinghouse Electric Corp. Research Labs., Pittsburgh.
RESEARCH AND DEVELOPMENT IN HIGH STRENGTH HEAT RESISTANT ALLOYS. Interim Report No. 3 Covering Period October 27, 1958 through December 26, 1958. L. L. France. Jan. 19, 1959. 15p. Contract NOas-58852-C.

The non-consumable arc melting of alloy buttons was continued. The preliminary structure studies of the W-Hf and the Ta-Hf alloy systems are near completion. The ternary alloy system W-Ta-Hf is currently being studied to determine the limits of the solid solution body-centered-cubic phase region adjacent to the W-Ta side of the ternary system. Work has recently started on the Ta-Re system and will soon be extended to the W-Re and W-Ta-Re alloys. (For preceding period see NP-7638.) (J.R.D.)

8721 AD-214473
Westinghouse Electric Corp. Research Labs., Pittsburgh.
RESEARCH AND DEVELOPMENT IN HIGH STRENGTH HEAT RESISTANT ALLOYS. Interim Report No. 4 [for] December 27, 1958 through February 26, 1959. L. L. France. Mar. 13, 1959. 21p. Contract NOas-58852-C.

Preparation of non-consumable arc melted buttons was continued. Investigation of the Hf–Ta–W is proceeding and data are summarized. Investigations of the Ta–Re system were continued and extended to the W–Re and W–Ta–Re alloys. Mechanical property and oxidation studies were continued. (For preceding period see 214093.) (J.R.D.)

8722 AD-216781
Westinghouse Electric Corp. Research Labs., Pittsburgh.
THERMOELECTRICITY QUARTERLY PROGRESS REPORT NO. 2. May 11, 1959. Addendum: COMPUTATION OF EFFICIENCY OF THERMOELECTRIC DEVICES. Scientific Paper 431FD410-P3. B. Sherman, R. R. Heikes, and R. W. Ure, Jr. RADIATIVE HEAT TRANSFER IN THERMOELECTRIC MATERIALS. Research Memo 431FD410-M1. T. D. Holstein. 161p. Contract NOBS-77043.

Work is continuing on all the materials discussed in the first Quarterly Report. In addition, studies on several new perovskite systems were initiated. Experiments directed at determining vapor pressures of thermoelectric materials are described. Such data are used in evaluating various encapsulating techniques. Atmospheres which will improve high temperature stability are being investigated. Thermoelectric parameters of all materials included in the study are tabulated. Calculations of the efficiency of thermoelectric generators received a great deal of attention and it is shown that parameter averages give results which are accurate for most purposes. Another important aspect of high temperature materials development is the consideration of the thermal conductivity due to radiation. Interpretation of data indicates that only narrow band materials will be successful in the region of 1000 to 2000°C. (auth)

8723 AD-217227
Westinghouse Electric Corp. Research Labs., Pittsburgh.
THERMOELECTRICITY PROGRESS REPORT NO. 7. Aug. 31, 1958. 52p. Contract NOBS-72361.

Design of a quiet, efficient thermoelectric generator is discussed. Methods of calculating the theoretical efficiency of thermoelectric generators for arbitrary variation of electrical resistivity, thermal conductivity, and Seebeck coefficient with temperature are presented. Reduction of the equations to a form which can be adapted to a computer is described. Measurements of the electrical and thermal conductivity and Seebeck coefficient of InSb in series indicate an over-all generation efficiency of about 6% when used in conjunction with p type materials of similar characteristics. Data and parameter calculations for optimization of a conventional-fuel-fired thermoelectric generator are also included. (For preceding period see AD-215693.) (J.R.D.)

8724 AD-217783
Climax Molybdenum Co. of Michigan, Detroit.
DEVELOPMENT OF TUNGSTEN-BASE ALLOYS. Interim Report No. 2 Covering Period January 1, 1959 to April 30, 1959. M. Semchyshen and R. Q. Barr. May 1, 1959. 18p. Contract NOas 58-847-c.

Four tungsten-base alloys were arc-cast, in which the alloy additions were graded. The systems under investigation are tungsten–zirconium, tungsten–tantalum, tungsten-hafnium and tungsten–cobalt. Hardness values at room temperature and elevated temperatures are reported for a number of compositions. (auth)

8725 AD-218298
New York. State Univ. Coll. of Ceramics, Alfred.
GRAIN SIZE EFFECTS ON THE THERMAL CONDUCTIVITY OF CERAMIC OXIDES. Progress Report No. 9 [for] February 1, 1959 to April 30, 1959. R. K. Francis, R. S. Truesdale, and J. R. Tinklepaugh. 20p. Project No. 7022. Contract AF33(616)-3798.

Alumina and magnesia specimens were hot pressed for use in studies of grain growth as a function of time, temperature, and pressure. It was found that commercial aluminas can be hot pressed to 96% of theoretical density with a grain growth factor of 1.5. Other commercial alu-

minas were difficult to polish, and improved polishing techniques are indicated. Preliminary studies on magnesia indicate that dense specimens can be obtained by hot pressing at 1650°C and 3000 psi. Specimens of magnesia pressed to 99% of theoretical density in 8.5 minutes had a grain growth factor of about 12 to 14. (J.R.D.)

8726 AD-220535

Westinghouse Electric Corp. Research Labs., Pittsburgh. DEVELOPMENT OF A NICKEL-BASE MATERIAL DISPERSION-HARDENED BY ALUMINA FOR 1600°F TO 2000°F SERVICE. Progress Report No. 2 [for] March 7, 1959 to May 6, 1959. D. H. Feisel. May 20, 1959. 22p. Contract NOas-59-6051-C.

A limited scope literature survey of work directly related to this project was completed on dispersion hardening and on the enhancement of elevated temperature properties by ordering. The equipment necessary to handle the pyrophoric nickel-aluminum powder used as a starting material for preparation of the experimental alloys was assembled. Several cold-compacted mixes were made, and an improved hot pressing system is under construction. (auth)

8727 AD-220537

National Carbon Co. Research Labs., Cleveland. THERMOELECTRIC MATERIALS. Bi-monthly Progress Report No. 1 [for] January 28–March 28, 1959. N. R. Thielke, comp. Apr. 15, 1959. 30p. Contract NObs-77066.

The thermoelectric properties of carbon, graphite, refractory nitrides, and alkali metals are being studied. (W.L.H.)

8728 AD-225378

Stanford Research Inst., Menlo Park, Calif. THERMOELECTRIC MATERIALS. Bimonthly Progress Report for February 1, 1959 to April 1, 1959. (Report No. 2). J. W. Johnson. Apr. 20, 1959. 7p. SRI Project No. SU-2681. Contract NObs-77017.

Investigation of the thermoelectric properties of phthalocyanines was continued. Resistance-temperature relations for a pellet of this material are shown graphically and the energy, E = 1.385 ev, was calculated from the slope. Data are also given on the thermal electromotive force of this pellet at 220°C. Resistance measurements of Cu_2S at 400 to 1200°C were made in a quartz cell constructed for this purpose. These data are included along with data on thermal emf. (For preceding period see NP-7751.) (J.R.D.)

8729 AD-225461

Westinghouse Electric Corp. Research Labs., Pittsburgh. RESEARCH AND DEVELOPMENT IN HIGH STRENGTH HEAT RESISTANT ALLOYS. Interim Report No. 5 [for] February 27, 1959 through April 26, 1959. L. L. France. May 20, 1959. 23p. Contract NOas-58852-C.

The preparation of non-consumable arc melted buttons required for the Phase I study of the W-Ta-Hf ternary system was essentially completed. The majority of the specimens of the W-Ta-Re system were also prepared. Investigation of the as-cast microstructure and hardness of these alloys is near completion. The determination of the 2000°C phase diagram isotherm was initiated and is progressing satisfactorily. Determination of workability, oxidation studies and the investigation of analytical methods were continued. (For preceding period see AD-214473.) (auth)

8730 AD-226333

Ohio State Univ. Research Foundation, Columbus. RESEARCH ON THE OXIDATION BEHAVIOR OF TUNGSTEN. Quarterly Progress Report No. 4 for March 16, 1959 to June 30, 1959. Rudolph Speiser. July 1, 1959. 85p. RF Project 831. Contract AF33(616)-5721.

Experiments were conducted to determine the oxidation characteristics of commercially pure tungsten in the temperature range of 680 to 1100°C at partial pressures of oxygen from 0.05 to 0.21 atmosphere. The mechanism of oxidation of tungsten in air was found to occur by the diffusion of oxygen ions through the scale to the metal-oxide interface. Initially the kinetics of oxidation follow a parabolic rate law. This parabolic behavior is subsequently replaced by linear rate behavior. Three oxides were observed to play a part in the oxidation of tungsten. The first oxide, WO_2, was apparent only at low temperatures and for very short times. The second oxide is thought to be $W_{18}O_{49}$ or $W_{20}O_{58}$. This blue oxide, which appeared to be very dense and adherent, grew rapidly to a limiting thickness of approximately 10 microns. The third oxide, or outer oxide, was identified as WO_3. This oxide existed at all temperatures and was formed with a physically porous structure. A reduction in the partial pressure of oxygen decreases the linear and parabolic rate constants and increases the thickness of the blue oxide layer. The activation energies were calculated from rate constant data and were found to be 35.0 K cal in the parabolic range and 36.5 K cal in the linear range. The fact that the activation energies are approximately equal indicate that diffusion through the blue oxide layer is the controlling step in both processes. (auth)

8731 AECU-4458

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research. HIGH-DIELECTRIC-CONSTANT MATERIALS AS CAPACITOR DIELECTRICS—A STUDY IN DIELECTRIC SPECTROSCOPY. Final Report. Technical Report No. 145. A. von Hippel and W. B. Westphal. Dec. 1959. 76p. Contract AT(30-1)-1937. OTS.

A fundamental study is presented comparing the electric properties for materials of "normal" dielectric constant (Al_2O_3 and $MgTiO_3$) with those of high dielectric constant (TiO_2, $CaTiO_3$, $SrTiO_3$, $[Ba_{0.65}Sr_{0.35}]TiO_3$, and $BaTiO_3$). Single crystals and ceramics, as far as available, were investigated from d-c to the microwave range as function of time, temperature, field strength, and prehistory. Three types of relaxation spectra were identified, one caused by dipolar groups in unequal double wells, the other two by charge carriers stopped in the volume of the material or in front of the electrodes, respectively. O-H groups in rutile, identified by infrared absorption, seem to cause a dipolar spectrum by thermal excitation leading to hydrogen-bond formation. The shielding of dipoles by countercharges (dipole halos) is probably responsible for the unequal potential wells and likely to be a phenomenon of general importance. Electrons can be injected into rutile and other titanates by field emission. Parallel to the optic axis of rutile, the conduction currents reach especially high values because of an unhampered $Ti^{3+} \rightarrow Ti^{4+}$ exchange, and thermal breakdown by field-emission currents occurs. Pure titania materials at high temperatures become very lossy because of thermal electron activation from O^{2-} to Ti^{4+} The nonlinear response characteristics of $BaTiO_3$ and $(Ba_{0.65}Sr_{0.35})TiO_3$ are measured in the ferroelectric and paraelectric range and the onset of ferroelectricity for $SrTiO_3$ at liquid-helium temperature. Some d-c breakdown data are given for ceramics, and impulse and d-c strength measurements on rutile single crystals parallel and perpendicular to the axis. Voids, visible in x-ray micrographs, keep the breakdown strength of sintered ceramics rela-

tively low; conduction holds the electric strength of rutile crystals in d-c tests to low values. Titanate ceramics at present allow an increase of storage density of capacitors by a factor of 5 to 10, a gain not attractive in view of the difficulties involved; a factor 10^3 might be realizable in the not too distant future. (auth)

8732 AECU-4684

California. Univ., Berkeley. Minerals Research Lab.
THE INFLUENCE OF POINT DEFECTS ON THE MECHANICAL PROPERTIES OF LITHIUM FLUORIDE. Technical Report No. 1. J. Nadeau and J. Washburn. Jan. 1960. 79p. Project No. 28. Contract AT(11-1)-34. OTS.

Lithium fluoride crystals were quenched into silicone oil from near the melting point. The return to an equilibrium structure during annealing was observed by means of mechanical tests and etching techniques. Crystals containing three levels of impurity, zone refined, commercially pure, and doped with 0.05 mole per cent magnesium, were used in order to separate the effects of foreign ions from those of thermal vacancies. The changes of mechanical properties produced by quenching and by subsequent annealing were generally attributable to point defect-dislocation interactions. Precision density determinations indicated that about 10% of the equilibrium concentration of vacancies at the melting point was retained at room temperature by the quench. The density could be restored to its normal value by annealing. Two important annealing stages were observed. At about 200°C the precipitation of impurities retained in solution by the quench caused a sharp increase in the hardness as measured at room temperature. Isothermal annealing revealed the hardening process to have an activation energy of about 0.5 ev which is probably the energy for migration of an associated magnesium ion-lithium vacancy pair. Between 300 and 400°C the removal of dislocations and probably vacancy clusters resulting from the quench caused pronounced softening so that the quenched-annealed crystals were softer than as-grown-annealed crystals. (auth)

8733 AECU-4698

Denver. Univ. Denver Research Inst.
STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON–ALUMINUM ALLOYS. Monthly Letter Report No. 10 [Covering Period] March 15, 1959 to March 15, 1960. Frank C. Perkins and Joseph F. Nachman. Feb. 9, 1960. 4p. Contract AT(11-1)-742. OTS.

Progress is reported on the program to determine the effect of variations of Al content, heat treatment, and basic slip mechanism upon the room-temperature ductility of Fe–Al alloys. (W.L.H.)

8734 AERE-M/TN/18

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE METALLURGICAL CHARACTERISTICS OF THE HEAVY ELEMENTS. B. W. Mott. Dec. 1952. 12p.

A review is given of the published data on the heavy metals and their compounds including the crystal structures, atomic sizes, valencies, and magnetic properties. (auth)

8735 AERE-X/PR-2653/6/59

Gt. Brit. Explosives Research and Development Establishment, Waltham Abbey, Essex, England.
THE THERMAL CONDUCTIVITY OF SANTOWAX R BETWEEN 155 AND 400°C. H. Ziebland and J. T. A. Burton. May 1959. 12p.

The thermal conductivity of Santowax R was measured at 155 to 392°C. The conductivity of this material is expressed by $10^4 \times k = 3.516 - 0.0028\ T$ where k is the thermal conductivity in cal/cm sec degree C, and T the temperature in °C. (J.R.D.)

8736 ARF-2131-7

Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DEVELOPMENT OF COBALT-BASE ALLOYS. Quarterly Report No. 1 [for] December 15, 1958–March 31, 1959. J. J. Rausch and Charles R. Simcoe. May 13, 1959. 17p. Contract NOas 58-136-c. (AD-217539).

Ternary alloys containing combinations of Mo, Nb, Ta, Ti, and W produced alloys with tensile strengths of 60,000 to 80,000 psi at 1700°F. No oxidation-resistant complex alloys were found other than those containing significant amounts of Cr or Si. Ternary alloys of Co, Cr, and Mo had tensile strengths of 85,000 to 90,000 psi at 1700°F. These alloys were forgeable and oxidation resistant. Their main disadvantage was marginal ductility. Tantalum was found to alloy well with other strength-promoting elements, whereas titanium was generally unsatisfactory by lowering the melting point of the complex alloy if appreciable quantities were added. (C.J.G.)

8737 ARF-2165-4

Illinois Inst. of Tech., Chicago. Armour Research Foundation.
IMPROVED VANADIUM-BASE ALLOYS. Bimonthly Report No. 4 [for] June 1–July 31, 1959. B. R. Rajala and R. J. Van Thyne. 14p. Contract 59-6050 c. (AD-226413).

Promising V–Ti–(Nb, Ta, Mo, W) sheet alloys are being investigated since vanadium-base materials exhibit an excellent combination of fabricability and elevated-temperature strength. Tensile testing has been extended to 2000°F (1090°C). Specimens were protected by an inert atmosphere at the elevated temperatures because of lack of oxidation resistance. The V–5 Ti–20 wt.% Nb alloy exhibits tensile strengths of about 70,000 and 47,000 psi at 1800 and 2000°F, respectively. Trends indicate that further improvement by alloying is likely and that vanadium alloys may retain useful tensile strengths to higher temperatures. (auth)

8738 ARF-2175-1

Illinois Inst. of Tech., Chicago. Armour Research Foundation.
AN INVESTIGATION OF METAL–CERAMIC COMPOSITES FOR HIGH-TEMPERATURE APPLICATIONS. [Monthly Progress Report No. 1 for] April 14, 1959 to April 30, 1959. Sherwood W. McGee. May 15, 1959. 7p. Contract DA-11-022-505-ORD-3038. (AD-217445).

A series of experiments for the evaluation of structural parameter for metal fiber–ceramic composite materials is reported. (W.L.H.)

8739 CAL-KB-1028-M-23

Cornell Aeronautical Lab., Inc., Buffalo.
CARBON–TITANIUM–BORON STEEL EVALUATION FOR HIGH-TEMPERATURE SERVICE. Final Report [for] October 24, 1955 to August 31, 1957. John Salvaggi. 34p. Contract NObs-72016. (AD-207504).

The effects of variation in chemical composition upon the additions of boron and titanium on the tensile and impact properties at room temperature and the creep and stress-rupture properties at 950 to 2000°F of a low carbon steel intended for use as boiler tubes, were evaluated. The short time properties were found to vary over the range of chemical composition tested. The variation in properties decreased with time and the long-time properties, which

would be used to define the limits of stress and temperature for boiler tubes, are about the same for the high and low ends of the composition range. Differences in heat treatment were found to have a much more pronounced effect on properties. Solution temperatures of 2000°F and higher are required for development of optimum strengths. Some room temperature impact resistance is sacrificed in obtaining high strength values at elevated temperatures. (auth)

8740 CNLM-1802-5

Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.

THE OXIDATION OF Cr, Hf, Mo, Nb, Ta, Ti, W, V, Zr, AND SOME OF THEIR ALLOYS; PROPERTIES OF SOME BORIDES, CARBIDES, NITRIDES AND OXIDES OF THE SAME METALS. A Bibliography. E. A. Cernak, comp. Dec. 15, 1959. 99p.

A bibliography of 922 references is given on the oxidation kinetics and mechanism of Cr, Hf, Mo, Nb, Ta, Ti, W, V, Zr, and some of their alloys. The properties of niobium and niobium alloys, properties of some borides, carbides, oxides, and nitrides of the above metals, and properties and structures of spinels are covered. The bibliography covers the period 1951 to September 1959. (C.J.G.)

8741 CRMet-863

Atomic Energy of Canada Ltd., Chalk River, Ont.

A METALLOGRAPHIC STUDY OF THE BEHAVIOUR OF HELIUM IN ALUMINUM. C. E. Ells and W. Evans. Oct. 1959. 35p. (AECL-918). AECL.

Helium was introduced into several types of aluminum and aluminum-rich alloys by irradiation in an alpha-particle beam. The effect of helium (0.5 cm^3/cm^3) on the structure of the metal was studied by metallographic techniques. It was shown that helium acts as a grain-growth inhibitor, collects vacancies at certain points of nucleation, and under sufficiently severe annealing conditions forms gross bubbles. The results can, in general, be explained by accepted ideas on the behavior of inert gases in metals and have shown the importance of second-phase particles in producing enhanced bubble formation. (auth)

8742 HW-28035

[Hanford Atomic Products Operation, Richland, Wash.].

THE IDENTIFICATION OF THE ANGULAR INCLUSIONS PRESENT IN ROLLED URANIUM. F. A. Scott. May 15, 1953. Decl. Jan. 28, 1960. 5p. OTS.

Investigations to determine the properties of minute angular inclusions found in Hanford U were conducted. Analytical results are tabulated along with isolation methods. (J.R.D.)

8743 HW-30183

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE IDENTIFICATION OF THE MICROSCOPIC ANGULAR INCLUSIONS IN URANIUM. F. A. Scott. Dec. 14, 1953. Decl. Jan. 28, 1960. 22p. Contract W-31-109-Eng-52. OTS.

Four chemical methods for the isolation of U inclusions were developed. Samples of inclusions were isolated from Mallinckrodt derby metal, rolled U, and Hanford recast U. X-ray-diffraction patterns of the isolated inclusions prove them to be primarily UN in the case of the derby metal, UC in the case of the rolled U, and a mixture of UC and UO_2 in the case of the Hanford recast material. Chemical analyses have been performed on the isolated materials and support the x-ray data. The metallic elements which are present in U in trace amounts were found to concentrate markedly in the isolated material. Theories are proposed to account for this concentration. (auth)

8744 HW-61681

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THERMAL CYCLING OF PLUTONIUM. PART I. OBSERVATIONS OF THE PHYSICAL DAMAGE RESULTING FROM THERMAL CYCLING PLUTONIUM THROUGH ITS LOW TEMPERATURE PHASE TRANSFORMATIONS. R. D. Nelson. Sept. 16, 1959. 30p. Contract AT(45-1)-1350. OTS.

Plutonium, thermally cycled through the low-temperature allotropic transformations, exhibited extensive physical damage. The physical damage was greater than that reported for any other metal or alloy. The extent of physical damage was determined by measurements of fluid displacement and the dimensional changes. The internal porosity was examined metallographically. Physical damage varied considerably, depending on the cycling conditions and the characteristics of the metal (particularly inclusions and casting imperfections). Observations showed that increasing the specimen size produced a greater decrease in density as a function of the number of cycles. The degree of void formation was directly proportional to volume change associated with the phase transformation. Other variables such as the length-diameter ratio (constant diameter) had little or no influence on the amount of physical damage. The dimensional growth was both radial and longitudinal. The tensile strength and the yield strength of tensile specimens cycled ten times between the gamma and alpha phases were decreased to an average of 30,000 and 26,000 psi, respectively. (auth)

8745 NACA-RM-L56J09

Langley Aeronautical Lab., Langley Field, Va.

EXPLORATORY MATERIALS AND MISSILE-NOSE-SHAPE TESTS IN A 4,000°F SUPERSONIC AIR JET. Paul E. Purser and Russell N. Hopko. Dec. 13, 1956. Decl. Sept. 1, 1959. 11p.

Some exploratory materials and nose-shape tests were made in a small supersonic air jet having a stagnation temperature of approximately 4,000°F. The materials considered included graphite, copper, carbon steel, and stainless steel; the nose shapes included 90° total-angle cones, hemispherical-face cylinders, and flat-face cylinders. The graphite model suffered less damage in 17 sec than did the steel model in 10 sec, which indicates promise as a heat-sink material. The tests also indicated that flat-face cylinders appear to be subject to approximately one-half the aerodynamic heat input as are hemispherical-face cylinders. (auth)

8746 NP-8344

Honeywell Research Center, Hopkins, Minn.

REVIEW OF THE THERMAL RADIATION PROPERTY VALUES FOR METALS AND OTHER MATERIALS. G. G. Gubareff, Shao-Yen Ko, and P. E. McNall, Jr. May 1956. 261p. (GR-2462-R3).

Thermal radiation property values for more than 40 metals and their alloys are given. The properties reported are emissivity, absorptivity, reflectivity, and transmissivity at various surface conditions, temperatures, and wavelengths. In addition, radiation properties of building materials, paints, glasses, papers, cloths, and other miscellaneous solid materials have been compiled, and solar absorptivity and equilibrium temperatures for various materials have been tabulated. These values have been gathered from about 200 references in English, German, French, and Russian and have been carefully

analyzed to obtain, in the authors' opinion, the most trustworthy data for practical application. Recommended data for technically important materials are also presented graphically. An extensive survey was conducted to compile values for Stefan-Boltzman's, Planck's, and Wien's constants, and the most reliable values for practical application are listed in a separate table. The thermal radiation equations are introduced, and a short discussion of the basic mechanism of heat transfer by radiation and the general tendencies of thermal radiation properties is given. Definitions of the radiation properties and their mutual relationships are also included. (auth)

8747 NYO-4834

Massachusetts Inst. of Tech., Cambridge.

X-RAY MEASUREMENT OF TWIN FAULTING IN FCC METALS. B. E. Warren. [1959]. 9p. Contract AT(30-1)-858. OTS.

A method of x-ray measurement of twin faulting in face-centered cubic metals is described. The method combines the tails of the (111) and (200) reflections and therefore allows a determination which is more nearly independent of tail overlapping and choice of the peak origin. The method was applied to the determination of twin fault probabilities in 70-30α brass for which a value of 0.07 was obtained for β. This value is in good agreement with Wagner's result. (C.J.G.)

8748 NYO-4835

Massachusetts Inst. of Tech., Cambridge.

SMALL ANGLE INTENSITIES FROM DOUBLE BRAGG REFLECTIONS IN COLD WORKED METALS. B. E. Warren. [1959]. 12p. Contract AT(30-1)-858. OTS.

The small angle intensity from a cold worked polygrained metal is treated in terms of double Bragg reflections. It is assumed that cold work breaks up the original grains into subgrains with varying orientations, such that a first reflection in one subgrain can be followed by a second reflection in another subgrain of the original grain. For an initial sample which is polygrained with random orientation, the small angle intensity resulting from cold work is given in absolute units in terms of two parameters: an average initial grain size G, and a subgrain correlation function $p(\phi)$ giving the distribution in orientation of subgrains with respect to any average subgrain of the original grain. Under favorable conditions, both of these quantities can be obtained from the small angle intensity curve. It is concluded, in agreement with Ogier, et al., that small angle intensity measurements from a cold worked polygrained sample are capable of giving a subgrain correlation function $p(\phi)$ representing the distribution in tilts of the subgrains relative to any average subgrain of the original grain. (auth)

8749 ORNL-2885

Oak Ridge National Lab., Tenn.

THERMODYNAMIC PROPERTIES OF THE URANIUM MERCURIDES (thesis). H. C. Forsberg. Feb. 29, 1960. 59p. Contract W-7405-eng-26. OTS.

Submitted to the Univ. of Louisville.

The thermodynamic properties of the mercury-uranium alloys were investigated. By means of vapor pressure measurements, using a dew point method, the mercury vapor pressure of the uranium-mercury system was determined as a function of both composition and temperature. The ΔF, ΔH, and ΔS of formation of three intermetallic compounds formed from uranium and mercury were calculated. The phase diagram for the system was re-evaluated and corrected. The vapor pressure relationships between the temperatures 175 and 375°C were determined. (auth)

8750 RFP-148

Dow Chemical Co. Rocky Flats Plant, Denver.

THE COEFFICIENT OF THERMAL EXPANSION OF ALPHA URANIUM AS FABRICATED BY VARIOUS METHODS. G. E. Bobeck. Feb. 8, 1960. 16p. Contract AT(29-1)-1106. OTS.

The coefficient of thermal expansion of alpha-uranium at −60 to +75°C was studied. This work was performed on alpha-uranium that had been fabricated by casting in a cylindrical ring shape. Similarly shaped samples were fabricated by casting 0.2% molybdenum in alpha-uranium, by form-rolling alpha-uranium sheet, and by drawing alpha-uranium sheet. The coefficient of thermal expansion of alpha-uranium that had been rolled according to various schedules to sheets of various thicknesses was also measured. From these measurements the expansion characteristics of alpha-uranium fabricated by means of a given technique are known and can be taken into account in design engineering. (auth)

8751 TAM-156

Illinois. Univ., Urbana.

THE STRAIN RATE AND TEMPERATURE DEPENDENCE OF THE DUCTILE TO BRITTLE TRANSITION IN MOLYBDENUM SUBJECTED TO TORSIONAL LOADING. D. Weinstein, G. M. Sinclair, and C. A. Wert. Dec. 1959. 21p. Project title: MECHANISMS OF DUCTILITY AND FRACTURE. Task title: THE KINETICS AND ENERGIES OF CRACK INITIATION, CRACK PROPAGATION AND FRACTURE. Contract AF33(616)-5153. (WADC-TN-59-2).

Brittle failure in annealed arc-cast molybdenum in torsion was studied as a function of strain rate and temperature. Strain rates ranged from 12.5 per sec to 0.005 per sec. The temperature dependence of the yield point for these different strain rates was used to calculate a heat of activation for the yield point. The heat of activation was not a constant but was approximately a linear function of the stress at yield. The value extrapolated to zero stress is 36,000 cal/mole which is close to a reported value of 33,400 cal/mole for C diffusing in molybdenum. It is proposed that the rate effect in yielding is determined in part by diffusion of C (or other interstitial atom) in the metal. (auth)

8752 UNM-290-198

New Mexico. Univ., Albuquerque. Engineering Experiment Station.

TITANIUM DIOXIDE AS A SEMICONDUCTOR. Richard Bechtel, Goebel Davis, Jr., and W. W. Grannemann. [Period covered] November 6, 1958 to November 6, 1959. 12p. For Sandia Corp. Contract No. 51-5982. (SCDC-952). OTS.

A study was made of the electrical properties of semiconducting TiO_2. (W.L.H.)

8753 WADC-TR-58-340

Minnesota. Univ., Minneapolis.

FATIGUE, CREEP, AND RUPTURE PROPERTIES OF THE ALLOYS UDIMET 500, HASTELLOY R-235, AND GMR-235. Period covered: January 1956 to December 1957. F. H. Vitovec. May 1958. 72p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE AND CREEP OF MATERIALS. Contracts AF33(616)-2803 and AF33(616)-5449. (AD-202502).

Fatigue, rupture, and creep data at 1200 and 1650°F obtained under various combinations of mean and alternating stress are presented. Tests were performed under axial stress on unnotched specimens and specimens having a theoretical stress concentration factor of 3.4. The data are

presented as S-N curves and stress range diagrams to show the effect on the fatigue and creep properties of stress concentration, temperature, ratio of alternating-to-mean stress, and stress magnitude. (auth)

8754 WADC-TR-59-19

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT AND EVALUATION OF HIGH-TEMPERATURE TUNGSTEN ALLOYS. Period covered: May 1, 1957 to September 30, 1958. F. C. Holtz and R. J. Van Thyne. Apr. 1959. 41p. Project No. 7308. Contract AF33(616)-5218. (AD-220110).

Alloys containing a minimum of 90 wt. % tungsten were developed for use at temperatures up to 2000°F. Compositions based on the W–Ni–Fe system were prepared by cold-pressing blended metal powders, followed by liquid-phase sintering in hydrogen. The sintered products consisted of rounded, tungsten-rich grains in a W–Ni–Fe solid solution matrix. Ternary alloys containing up to 98 wt. % tungsten were investigated; materials at the 95 wt. % tungsten level were very ductile and could be rolled at room temperature. The hardness of cold-rolled specimens decreased upon annealing at temperatures above 1400°F. Maximum tensile strength values of 34,000 psi at 2000°F occurred at the 97 wt. % tungsten level. Tensile elongations decreased above 1000°F, and these ternary materials had a 100-hour rupture life at a stress level of about 2500 psi at 2000°F. The effects of tungsten contents, nickel-to-iron ratios, and quaternary additions on properties of W–Ni–Fe alloys were studied at room temperature and at 2000°F. Increasing amounts of tungsten resulted in lower ductility and slightly higher strength. Optimum nickel-to-iron ratios were dependent on the tungsten levels. Proportionally higher iron contents increased tensile strength and decreased elongation at elevated temperature. The elements Al, Cr, Mo, Nb, Ta, and Ti were added to a 90W–Ni–Fe-base. Room-temperature strength and ductility of this base were lowered by 2.5 wt. % of Cr, Nb, and Ta, and by 0.5 wt. % of Al and Ti. Moderate improvements in elevated temperature properties were noted in alloys containing 2.5 wt. % Cr, Mo, and Ta. Oxidation resistance, slightly inferior to that of unalloyed tungsten, was not materially affected by the small quaternary additions. Blended W–Ni–Fe powders were hot-pressed in graphite dies, using induction heating. The compacts were relatively fine-grained and had a thin carbide layer on the surfaces. Densities were usually above theoretical values due to squeeze-out of the very fluid matrix phase. Ingots of unalloyed tungsten and a 90W–10Nb alloy prepared by consumable-electrode arc-casting had a coarse, columnar grain structure and were not amenable to working. (auth)

8755 WADC-TR-59-131

California. Univ., Berkeley. Inst. of Engineering Research.

THE EFFECT OF HIGH TEMPERATURE RECOVERY ON THE CREEP OF POLYCRYSTALLINE ALUMINUM IN THE DISLOCATION CLIMB REGION OF TEMPERATURES. Period [covered]: January 31, 1958 to January 31, 1959. W. D. Ludemann, L. A. Shepard, and J. E. Dorn. Feb. 3, 1959. 32p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE AND CREEP OF MATERIALS. Contract AF33(616)-3860. OTS.

The creep resistance of 99.99% pure aluminum was studied at 540, 573, 600, and 611°K. Polycrystalline specimens crept under a stress of 950 psi to a strain of 5.5% were allowed to recover for periods of from one minute to sixteen days under a residual stress of 4.4 psi. Increased creep rates upon reapplication of the 950 psi stress evidenced softening of the material. The activation energy for the recovery process was found to be 64,000 cal/mole. Metallographic studies of the specimens showed relief of local elastic strains by coalescence of dislocations into subgrain boundaries upon recovery, and sub-boundary migration. The activation energy of 64,000 cal/mole indicates that recovery of creep resistance was due primarily to the sweeping out of dislocations within the grains by the migration of subboundaries. Indications of minor grain growth were also found. (auth)

8756 WADC-TR-59-342

Manufacturing Labs., Inc., [Boston].

INVESTIGATION OF THE STRENGTH AND DUCTILITY RELATIONSHIPS IN TITANIUM–ALUMINUM ALLOYS BETWEEN 6 AND 15% ALUMINUM FOR APPLICATION AT ELEVATED TEMPERATURES. Period covered: May 28, 1958 to May 14, 1959. B. S. Lement, G. T. Hahn, and K. Kreder. May 30, 1959. 72p. Project No. 7351. Contract AF33(616)-5948. OTS.

An investigation of the strength and ductility relationships in a series of Ti–Al alloys varying from 6 to 15% aluminum was carried out. The activation energy for the embrittlement reaction in a Ti–8Al alloy was found to be about 34,000 cal/mol. More complete evidence was obtained that striations represent sub-boundaries forming as a result of the beta-alpha transformation and at which micro-segregation occurs. Striations can be eliminated by cold working and recrystallizing, or by quenching and recrystallizing. Rapid quenching results in a martensitic structure which exhibits high resistance to embrittlement on subsequent aging at 750°F in a Ti–8Al alloy. In the embrittled condition fracture takes place by trans-granular cleavage. (auth)

8757 WAL-TR-320.4/1

Watertown Arsenal Lab., Mass.

LOW TEMPERATURE TENSILE-HARDNESS CORRELATIONS OF SAE 4340 STEEL. John Nunes and Frank R. Larson. Feb. 1960. 18p. DA Project No. 5B93-32-002. OTS.

Vickers hardness (DPH) and tensile strength (UTS) were studied on one heat of SAE 4340 steel as a function of testing temperature. Martensitic, bainitic, and pearlitic structures of various strength levels were tested in a temperature range of room temperature to −196°C. It was found that these two variables (DPH and UTS) are linear with respect to the reciprocal absolute temperature. The various strength levels formed a family of parallel lines. From this result it is shown possible to derive some simple empirical equations for calculating approximate values of DPH or UTS in the temperature range studied. It was established for SAE 4340 that the room temperature SAE hardness-tensile strength correlation is reasonably valid in the range of temperature studied. A more accurate hardness-tensile strength correlation for this material was established. (auth)

8758 WAPD-TM-185

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

THE DIFFUSION OF KRYPTON-85 FROM URANIUM DIOXIDE POWDER. A. B. Auskern. Feb. 1960. 13p. Contract AT-11-1-GEN-14. OTS.

The diffusion of Kr^{85} in two UO_2 powders was studied by performing a series of post-irradiation anneals on the powders. The emanation data were analyzed by considering the effect of sintering as well as the effect of a distribution of

particle sizes within the sample. Measurements were made at 900 to 1500°C. The time at a temperature was between 8 and 24 hours. The diffusion coefficients for Kr^{85} in the two powders are represented by the equations: $D = 2.65 \times 10^{-4}$ exp − 65,500/RT for UO_2 prepared from crushed UO_2 pellets and, for a chemically prepared UO_2 powder, $D = 4.9 \times 10^{-4}$ exp − 73,800/RT. (auth)

8759 JPRS-1128-D

STANDARDIZATION AND CLASSIFICATION OF PRECISION ALLOYS. D. A. Smolyarenko and T. S. Kaplan. Translated from Standartizatisiya, No. 3, 13-18(1959). 15p. OTS.

A standardization and classification plan is presented for the precision alloys: soft and hard magnetic alloys; alloys having a prescribed coefficient of thermal expansion; alloys having special elastic properties and high resistance; and alloys of other special properties. The alloys are classified according to basic characteristics and industrial applications. (C.J.G.)

8760 NP-tr-335

DETERMINATION OF THE DENSITY OF DISLOCATIONS ARISING DURING THE DEFORMATION OF Ni, Ag, Al AND CERTAIN Ag-ALLOYS. (Translation). S. D. Hertzricken and N. N. Novikov. [1958]. 30p. OTS.

Measurements are presented of the volumetric changes which occur during the annealing of specimens, deformed to varying degrees by torsions at room temperature, and also with calculating the quantity of defects which corresponds to the given quantity of relative change in volume. The measurements were performed on Ni, Ag, Al, Ag−Cd, Ag−In, Ag−Sn, Ag−Cu, and Ag−Au alloys. (W.L.H.)

8761 NP-tr-343

THERMOPHYSICAL PROPERTIES OF SUBSTANCES. (Teplofizicheskie Svoistva Veshchestv). I. I. Ayzenshtat, ed. Translated from a publication of the Printing House of State Publishing House for Power Engineering, Moscow. 479p. OTS.

The physical properties of various gases at standard pressure and various temperatures and the thermophysical properties of gases at various pressures and temperatures are tabulated. The thermal properties of steam and water at 0 to 700°C and under pressure from 1 to 400 kg/cm^2 are given. The physical properties of steam in the supercritical region and water near the critical point are included. Physical properties of various liquids including water, heavy water, high-boiling organic and inorganic liquids, low-boiling liquids, molten salts, and liquid metals are tabulated. The physical properties of organic and inorganic compounds, pure metals, and steels are given. Thermal conductivities of dry and moist insulating materials, refractories, and various inorganic compounds and metal oxides are given. Standards for thermocouples and resistance thermometers including various grades of platinum are tabulated. The characteristics of thermocouples at temperatures above 1500°C under laboratory and industrial conditions are reported. (C.J.G.)

8762

CRYSTAL STRUCTURE OF Nb_3Be_2. Allan Zalkin, Donald E. Sands, and Oscar H. Krikorian (Univ. of California, Livermore). Acta Cryst. 13, 160(1960) Feb. 10. (In English)

A sample of $NbBe_{1.10}$ composition was prepared from elemental powders contained in a BeO crucible by heating to 1550°C with an inductively heated molybdenum susceptor under argon. It was repeatedly crushed, blended, and reheated in vacuum at 1600 to 1750°C. Weight losses, attributed to vaporization of Be, indicated a final composition of $NbBe_{0.7}$. X-ray-powder-diffraction studies of a single crystal selected from this crushed product indicate additional phases in the composition range between Nb and $NbBe_2$. The observed and calculated hk0 structure factors for Nb_3Be_2 are presented in tabular form including the interatomic distances. (B.O.G.)

8763

PRESSURE-TEMPERATURE-DENSITY RELATIONSHIPS IN SEVERAL SAMPLES OF UO_2. W. G. Carlson, H. D. Root, and R. S. Shane (Westinghouse Electric Corp., Pittsburgh). Am. Ceram. Soc. Bull. 39, 69-73(1960) Feb.

Preliminary studies were made of certain process variables in the manufacture of high density urania bodies. Independent variables include: (a) reaction used to make UO_2, (b) ball-milling of UO_2, (c) pressing pressure, and (d) sintering temperature. The dependent variable was product density although other information such as grain size, linear shrinkage, and compressive strength was collected. (auth)

8764

ELECTRON MICROGRAPHY OF FILMS OF BERYLLIUM REDUCED FROM BULKY SPECIMEN. DEMONSTRATION OF SUB-STRUCTURE AND DISLOCATIONS. Adrien Saulnier and Paul Mirand. Compt. rend 250, 709(1960) Jan. 25. (In French)

A previously described technique for producing films about 100 A thick from large polycrystalline samples was used to prepare specimens for a micrographic study. The micrographs are shown and briefly discussed to demonstrate the method for studying the structural properties of Be. (T.R.H.)

8765

THE EFFECT OF THE TEMPERING TEMPERATURE ON THE PROCESS OF PROXIMATE ORDER FORMATION IN A Ni−Cr ALLOY. L. E. Popov and G. I. Karpov (Inst. of Physics and Tech., Kuibyshev Tomsk State Univ.). Doklady Akad. Nauk S.S.S.R. 129, 1028-30(1959) Dec. 11. (In Russian)

The effects of tempering temperature on ordering (K-state) in Ni−Cr alloys (16.6 wt.% Ni) were investigated. Wire specimens were annealed at 950°C for 4 hours followed by heating at 650, 750, 950, 1000, and 1100°C for 5 to 60 min and quenching in water. All the specimens were annealed at 300°C, and their electric conductivity was plotted as a function of tempering time and temperature. The mean activation energy was equal to 38.7 ± 2 kcal/mole. (R.V.J.)

8766

SOLUBILITY OF BERYLLIUM OXIDE IN A LIQUID COPPER−BERYLLIUM MELT. F. Sh. Muratov, A. V. Novoselova, and Chou-Sin (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 129, 1057-9(1959) Dec. 11. (In Russian)

The diffusion of beryllium oxide in a liquid copper−beryllium alloy (2% Be) at 1254 to 1517°C was investigated. (R.V.J.)

8767

THE EMBRITTLEMENT OF ALUMINIUM−MAGNESIUM ALLOYS BY SODIUM. C. E. Ransley and D. E. J. Talbot (British Aluminium Co., Ltd., Gerrards Cross, Bucks, Eng.). J. Inst. Metals 88, 150-58(1959) Dec.

The constitutional factors involved in the embrittlement of Al−Mg alloys by sodium were investigated, and it is shown that these particular alloys are susceptible to embrittlement because the sodium present in them is in the

elementary state. As the magnesium content increases there is a phase change involving a ternary Al–Si–Na compound and dissolved magnesium, the net result of which may be represented by the equation: [NaAlSi] + 2 Mg ⇌ Mg_2Si + Na "free." Solubility determinations on the compounds involved and hydrogen-adsorption measurements under various conditions show that the sodium is released when the magnesium content exceeds ~2%. The high-temperature properties in both tensile and impact tests are consistent with this result. The mechanism of the embrittlement is discussed in relation to other alloy systems in which trace elements lead to brittle behavior. The embrittlement is ascribed to the adsorption of sodium on internal surfaces generated in plastic flow and consequent modification of the growth of grain-boundary cavities. (auth)

8768

METALLURGICAL OBSERVATIONS OF NITRIDES IN CHROMIUM. I. S. Servi (Kelsey-Hayes Co., New Hartford, N. Y.) and W. D. Forgeng (Union Carbide Metals Co., Niagara Falls, N. Y.). J. Inst. Metals 88, 164-7(1959) Dec.

Electrolytic chromium flakes that had been heat-treated in hydrogen containing traces of nitrogen (< 0.001%) were found to be thermally etched on one side, while the opposite side was usually covered with small, vapor-deposited, crystals of chromium. Surface markings were present on both the small crystals and the thermally etched surfaces. The markings were the result of the presence of a yellowish metallic material along the grain boundaries and within the grains. This material was isolated from the chromium and identified by means of electron- and x-ray-diffraction patterns as a mixture of the chromium nitrides, Cr_2N and CrN, the former being the predominant phase. The presence of the nitrides is explained on the basis of thermodynamic data for the chromium–nitrogen system. (auth)

8769

HYDROGEN-DEPENDENT PRECIPITATES IN TITANIUM–CHROMIUM ALLOYS. L. H. Keys, I. R. Lamborn, and G. G. McDonald (Defence Standards Labs., Melbourne). J. Inst. Metals 88, 168-72(1959) Dec.

The identity of hydrogen-dependent precipitates, and the influence upon their characteristics of matrix structures resulting from decomposition of metastable β and martensitic α phases, were studied in two titanium–chromium alloys. Some effects of strain in promoting precipitation at room temperature are described. Although diffraction techniques failed to identify the precipitates, their characteristics strongly suggest that they are in fact hydrides. Some differences between the hydrides precipitated in structures resulting from the early and from the later stages of decomposition of martensitic α phase at elevated temperature are indicated. The behavior of the precipitates, together with results of x-ray diffraction examination of the matrices, suggested that after appropriate ageing at the elevated temperatures (420 and 500°C) used, both alloys are essentially all-α before the eutectoid reaction. (auth)

8770

HARDNESS CHANGES IN COLD-WORKED ALUMINIUM ALLOYS DURING SHORT AGEING TREATMENTS. N. Gane (United Kingdom Atomic Energy Authority, Industrial Group., Dounreay, Caithness, Scotland) and R. N. Parkins (King's Coll., Newcastle-on-Tyne, Eng.). J. Inst. Metals 88, 173-6(1959) Dec.

Certain binary aluminum alloys exhibit rapid softening on ageing for a few minutes at elevated temperatures, after being cold worked at room temperature. The effect is explained in terms of the unlocking of the dislocations from the solute atmospheres that form during deformation. The mechanism is consistent with the well-known effects of deformation upon the course of age-hardening, i.e., peak hardness is reached at shorter times than in undeformed alloys and a higher maximum hardness is obtained by cold working after ageing. (auth)

8771

FATIGUE DAMAGE AND CRACK FORMATION IN PURE ALUMINIUM. D. R. Harries (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and G. C. Smith (Cambridge, Univ., Eng.). J. Inst. Metals 88, 182-5(1959) Dec.

A statistical study was made of the effects of intermediate annealing on fatigue life of aluminum specimens tested in alternating torsion. Annealing at various stages of the fatigue life was found to have no significant effect on the total life to fracture. Periodic removal of the surface layers during the test enabled the fatigue life to be extended considerably. It is concluded that fatigue cracks initiate at the free surface of an even, axially stressed specimen. This is probably due to differences in the modes of deformation of the surface and the interior and not to the corrosive effect of the atmosphere. (auth)

8772

HEAT-TREATMENT AND THE DUCTILITY OF CHROMIUM. S. T. M. Johnstone, F. Henderson, and H. L. Wain (Aeronautical Research Labs., Melbourne). J. Inst. Metals 88, 189(1959) Dec.

The effects of nitrogen (up to 0.003 wt.%) on the ductility of chromium which has previously been annealed at high temperatures are discussed relative to rapid or slow rates of cooling following the anneal. (C.J.G.)

8773

HOW LOW TEMPERATURES AFFECT NINE HIGH STRENGTH ALLOYS. R. L. McGee, J. E. Campbell, R. L. Carlson, and G. K. Manning (Battelle Memorial Inst., Columbus, Ohio). Materials in Design Eng. 49, 3p.(1959) Nov.

The metallurgical and mechanical properties of aluminum, magnesium, and titanium alloys and steels were examined at 79 to –423°F. (C.J.G.)

8774

VAPOR PRESSURE AND THERMODYNAMIC PROPERTIES OF Zn–Zr AND Zn–U ALLOYS. Premo Chiotti (Iowa State Coll., Ames) and Gerald R. Kilp (Westinghouse Electric Corp., Pittsburgh). Trans. Met. Soc. AIME 218, 41-4 (1960) Feb.

Standard free energy, enthalpy, and entropy of formation for the compounds in the Zn–U and Zn–Zr systems were determined from zinc vapor pressure data. Relations for the zinc vapor pressure and free energy as a function of temperature are presented. (auth)

8775

THE EFFECT OF ZIRCONIUM ON THE PROPERTIES OF EXTRUDED MAGNESIUM–RARE EARTH METAL ALLOYS. J. F. Pashak and T. E. Leontis (Dow Chemical Co., Midland, Mich.). Trans. Met. Soc. AIME 218, 102-7(1960) Feb.

Zirconium additions to Mg-rare earth metal alloys exhibited little effect on the properties of extrusions. Higher strength properties and creep resistance were found in extruded alloys containing neodymium and praseodymium than in those alloys containing Mischmetal. Additions of 2 to 4 wt.% Zn to Mg-rare earth metal-Zr alloys did not appear promising for wrought products. (auth)

8776

THE RELATIONSHIP OF STRUCTURE TO MECHANICAL PROPERTIES IN UDIMET 500. Murray Kaufman and A. E. Palty (General Electric Co., West Lynn, Mass.). Trans. Met. Soc. AIME 218, 107-16(1960) Feb.

The phases present in a nickel-base, aluminum-titanium precipitation hardened alloy, Udimet 500, and their temperature dependence were investigated. The behavior of these phases together with the observed grain size variations produced a fairly good explanation of the changes in mechanical properties brought about by different fabrication and heat-treatment processes. (auth)

8777

SOME PROPERTIES AND METALLOGRAPHY OF STEEL-BONDED TITANIUM CARBIDE. Martin Epner (Sintercast Corp. of America, Yonkers, N. Y.) and Eric Gregory (Air Reduction Co., Murray Hill, N. J.). Trans. Met. Soc. AIME 218, 117-21(1960) Feb.

Composite materials consisting of alloy steels and up to 54 wt.% (65 vol.%) of titanium carbide are described. They are made by conventional powder-metallurgical techniques involving liquid-phase sintering and are capable of being annealed and hardened in a manner similar to alloy steels. In the annealed condition they can be machined; in the hardened condition their properties approach those of cemented tungsten carbide. The form and nature of the phases present in these structures was studied, and some of the effects on the properties of titanium-carbide concentration, alloying elements, and heat treatment are reported. A composition of 33 wt.% (45 vol.%) TiC with a chromium-molybdenum steel matrix, is described in detail. (auth)

8778

EFFECT OF RARE-EARTH ADDITIONS ON SOME STAINLESS STEEL MELTING VARIABLES. Rudolph H. Gautschi and Frederick C. Langenberg (Crucible Steel Co. of America, Pittsburgh). Trans. Met. Soc. AIME 218, 128-32(1960) Feb.

Rare-earth additions were made to laboratory heats of Type 310 stainless to observe their effect on as-cast ingot structure, nitrogen and sulfur contents, and nonmetallic inclusions. Lanthanum produced a grain-refining effect in 30-lb ingots, but results with 200-lb ingots were inconsistent. Cerium, lanthanum, and misch metal lowered the sulfur content when the sulfur exceeded 0.015 wt.% and the rare-earth addition was greater than 0.1 wt.%. The rare-earth content in the metal dropped very rapidly within the first few minutes after the addition. The size, shape, and distribution of nonmetallic inclusions was not changed in 30-lb ingots, but changes were noticed in larger ingots. (auth)

8779

HABIT PLANE OF HYDRIDE PRECIPITATION IN ZIRCONIUM AND ZIRCONIUM–URANIUM. F. W. Kunz and A. E. Bibb (General Electric Co., Schenectady, N. Y.). Trans. Met. Soc. AIME 218, 133-5(1960) Feb.

A platelet form of zirconium hydride was found in zirconium and Zr-1 wt.% U single crystals containing hydrogen in the range of 50 to 100 ppm. The habit planes for the hydride platelets in the zirconium crystals were found to be $\{1\,0\,\bar{1}\,2\}$, $\{1\,1\,\bar{2}\,1\}$, and $\{1\,1\,\bar{2}\,2\}$ while the habit planes in the Zr-1 wt.% U crystals were $\{1\,1\,\bar{2}\,1\}$, $\{1\,1\,\bar{2}\,3\}$, and $\{1\,2\,\bar{3}\,1\}$. With the exception of the $\{1\,2\,\bar{3}\,1\}$ plane, these were identified as the twin planes in zirconium. The different effect of hydride on the mechanical properties of zirconium at high and low strain rates was explained in terms of the deformation mechanism and the habit planes of the hydride. (auth)

8780

DEFORMATION TEXTURES IN ALUMINUM–URANIUM ALLOYS. W. C. Thurber and C. J. McHargue (Oak Ridge National Lab., Tenn.). Trans. Met. Soc. AIME 218, 141-4 (1960) Feb.

The cold-rolled textures of aluminum (99.996%), Al-5 wt.%U, and Al-13 wt.% U alloys were obtained to determine the effect of the dispersed phase UAl_4 on the texture of pure aluminum. There was an increase in spread and a decrease in intensity associated with increasing uranium content. A random texture was not obtained and results can be analyzed in terms of a change from a $\{5, 6, 16\} < \bar{1}\bar{0}, \bar{1}\bar{3}, 8 >$ (near $-\{113\} < \bar{3}\bar{4}3 >$) texture in the pure aluminum to a near $-$ < 111 > fiber texture in the 13 wt.% U alloy. (auth)

8781

A SOLIDUS MEASUREMENT TECHNIQUE FOR THE TANTALUM–RHENIUM SYSTEM TO 3000°C. J. H. Brophy and P. Schwarzkopf (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME 218, 184-5(1960) Feb.

A modification of the Mendenhall wedge blackbody was used to determine solidus temperature measurements in the rhenium–tantalum alloys up to 3000°C. The technique consisted of folding a 10-mil tantalum sheet, fashioning a 0.125 in. cavity in the middle, and twisting the ends; thereby forming a cylindrical-shaped crucible. Specimen temperature was observed by sighting into the cavity with an optical pyrometer. (C.J.G.)

8782

THE SYSTEM ZIRCONIUM–TELLURIUM. Harry Hahn and Peter Ness (Universität, Kiel). Z. anorg. u. allgem. Chem. 302, 136-54(1959) Nov. (In German)

In the system zirconium–tellurium the following compounds or phases have been confirmed by x-ray analysis: $ZrTe_3$ monoclinic, probably isotype with $ZrSe_3$; Zr_4Te_3 tetragonal as Zr_4Se_3 and Zr_4S_3; Zr_3Te_2 hexagonal, WC structure, range of homogeneity from $ZrTe_{0.5}$ to $ZrTe_{0.75}$; $ZrTe_2$ CdI_2-type; and ZrTe NiAs-type. There is a continuous transition from $ZrTe_{0.8}$ (NiAs lattice) to $ZrTe_2$ (CdI_2-type). A survey on the chalcogen compounds and phases of titanium, zirconium, and thorium is given. (auth)

8783

RECRYSTALLIZATION OF TITANIUM AND EFFECTS OF LIGHT-ALLOY ADDITIONS. Rudolf Reinbach (Vacuumschmelze AG, Hanau, Ger.). Z. Metallk. 51, 24-8(1960) Jan. (In German)

The influence of silver, aluminum, cobalt, chromium, copper, iron, germanium, hafnium, indium, manganese, molybdenum, niobium, nickel, tin, vanadium, and zirconium on the recrystallization of titanium is investigated. Additions of silver and hafnium as low as less than 1 at.% are particularly effective in retarding the recrystallization. A further improvement of the recrystallization behavior of titanium is possible by adding a third component. (auth)

8784

PROPERTIES OF REFRACTORY ALLOYS CONTAINING RHENIUM. Chester T. Sims and Robert I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). Preprint No. 164. Presented at the Forty-First Annual Convention of the American Society for Metals, Chicago, November 2–6, 1959. Cleveland, American Society for Metals, 1959. 14p.

The fabrication and properties of the refractory alloys of

molybdenum, tungsten, and tantalum with rhenium are presented. Molybdenum-rhenium and tungsten-rhenium show a considerable tensile strength advantage over the base metal at elevated temperatures. In the recrystallized condition, the alloys are significantly more ductile. Rhenium additions to tantalum do not promote fabricability although the extent of the alpha solid solution field is broad. Molybdenum-tungsten-rhenium ternary alloys have properties similar to those found for the binary system with rhenium. Solid solutions extend along a line roughly between W-25Re and Mo-35Re (atomic %) in the ternary phase field. (auth)

8785

TUNGSTEN: BIBLIOGRAPHY 1953–1958. PHYSICAL PROPERTIES AND PHASE DIAGRAMS. Towanda, Penna., Sylvania Electric Products, Inc. 42p. $1.00.

A bibliography of 409 references is given on the physical properties of tungsten, covering material published between 1953 to 1958. Phase diagrams of tungsten with various metals are given. (C.J.G.)

Radiation Effects

8786 AD-209574

Stanford Research Inst., Menlo Park, Calif.

EFFECT OF RADIATION ON THE MECHANICAL PROPERTIES OF PLASTICS. Quarterly Progress Report No. IV [for] May 15–October 15, 1958. David L. Chamberlain, Jr. Dec. 1, 1958. 37p. SRI Project No. SU-2296. Contract DA-04-200-ORD-698.

Investigations of the correlation between the physical and chemical effects of radiation and the dynamic elastic modulus of polymers are reported. Methods were developed for pressing uniform sheets of polyethylene and for shearing test reeds from these sheets. Four series of polyethylene and five series of polymethylmethacrylate reeds were prepared, irradiated, and subjected to vibrating reed apparatus tests. The irradiated polymethylmethacrylate samples were very brittle and several samples were broken in various stages of measurement subsequent to their irradiation. The effects of radiation on molecular weight of the methacrylate was determined from the viscosity of chloroform solutions of irradiated samples. The effects of the annealing procedure, accomplished according to published recommendations, on the methacrylate samples are shown in tables. Data on experimental work and plans for future investigations are included. (J.R.D.)

8787 AD-209722

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON SEMICONDUCTOR DIODES. Technical Memorandum No. 6. J. E. Drennan and S. E. Harrison. Dec. 31, 1958. 18p.

Results of experiments to determine the effects of radiation on diode circuit parameters are presented. Data and illustrations showing the effects of radiation on forward and reverse characteristics of several diodes are included. Fast neutrons affect diode forward characteristics through changes in the bulk material, and the reverse characteristics through changes in junction region. Slow neutrons are a major factor in damage by a mixture of neutron energies. Gamma radiation causes transient surface damage appearing as leakage characteristics. Germanium diodes fail in the reverse direction while failure in silicon rectifying devices results primarily from deterioration of the forward characteristics. A major factor determining the radiation resistance of semiconductor diodes appears to be the manufacturing process. (J.R.D.)

8788 AD-215599

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

GAMMA RADIATION EFFECT ON THE ELECTRICAL CONDUCTIVITY OF MATERIALS (thesis). Walter Frederick Pfeiffer. Mar. 1959. 72p.

A conductivity cell was designed and built to study electrical conductivity of materials in a high-intensity gamma-ray field. Results from measurements of the volume conductivity of a polyethylene disk were not significant because of problems which stemmed from polarization currents and non-ohmic relations for small voltages. The volume conductivity of a single crystal of sodium chloride varied linearly with gamma field intensity from 8×10^{-16} $(\text{ohm-cm})^{-1}$ at 3.5×10^{3} r/hr to 4×10^{-14} $(\text{ohm-cm})^{-1}$ at 2×10^{5} r/hr at 23°C. Comparison of results with theory developed by Rose indicates that the steady state Fermi level is among or above a uniform distribution of trapping energy levels in the energy gap. (auth)

8789 AD-217894

California Inst. of Tech., Pasadena. Electron Tube and Microwave Lab.

PLASMA INTERACTION RESEARCH PROJECT QUARTERLY STATUS REPORT NO. 1 [FOR] DECEMBER 1, 1958 TO FEBRUARY 28, 1959. Roy W. Gould and Daniel G. Dow. 18p. Contract DA36-039 SC-78230.

The exact theoretical solutions for propagation constants of waves in a plasma column were found for the special cases of infinite magnetic field and zero magnetic field. In addition, the problem was formulated for the case of finite magnetic fields, but solutions are not yet available. An experiment was designed to study the phase and attenuation constants of these modes over a wide range of parameters. A plasma traveling-wave tube was designed with the objective of studying the feasibility of useful plasma-mode amplifiers. Studies were conducted on the use of hydrogen rather than mercury as a vehicle for the plasma source. The results are unsatisfactory. (auth)

8790 AD-220269

Monsanto Chemical Co. Plastics Div., Springfield, Mass.

EVALUATION OF FILMS FOR IRRADIATION PACKAGING OF FOODS. Report No. 5 (Progress) [for] November 1, 1958–January 31, 1959. Charles T. Hathaway. 6p. Project No. 7-84-01-002. Contract QMR&D (Natick) No. 84 (Agreement).

Results are reported from an evaluation of pasteurization and sterilization levels of radiation on numerous polymeric films of interest for use in the packaging of foods before irradiation. Data are tabulated. (C.H.)

8791 AERE-M/TN-48

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

NEUTRON IRRADIATION OF SOME PERMANENT MAGNETS. J. Fennell, N. H. Hancock, and R. S. Barnes. Apr. 1958. 3p.

Data obtained in an investigation of neutron irradiation of ferromagnetic materials are presented. Specimens of aluminum–nickel steel and tungsten steel were magnetized and subjected to neutron fluxes of $1.5 \times 10^{12}/\text{cm}^2/\text{sec}$. Data are tabulated. (J.R.D.)

8792 AFCRC-TN-59-552

General Electric Co. Research Lab., Schenectady, N. Y.

SURVEY OF RADIATION DAMAGE THRESHOLDS. Scien-

tific Report No. 1. R. M. Walker. June 24, 1959. 34p. Contract AF19(604)-5557. (AD-225662).

One of the most important mechanisms leading to radiation-induced changes in materials is the process of direct displacement. In this process, target atoms receive energy from the incoming beam and recoil into new, interstitial positions in the lattice. The distinguishing feature of this type of radiation effect is that there is a minimum threshold energy which must be transmitted to the target atoms before changes will occur. A review is presented of existing information on threshold energies. Some preliminary new information on Au and Ag obtained under the present contract is also reported. Finally the general status of threshold measurements is discussed and promising lines of research are indicated. (auth)

8793 CEA-1080

France. Commissariat à l'Énergie Atomique, Paris.
ÉTUDE DES IMPERFECTIONS DE STRUCTURE DU FLUORURE DE LITHIUM IRRADIÉ (NEUTRONS THERMIQUES). (A Study on Structure Defects in Irradiated Lithium Fluoride (Thermal Neutrons)). Marianne Lambert. June 19, 1958. 81p.

Thesis submitted to the Univ. of Paris.

A study was made of the behavior of atomic defects, vacancies and interstitials, generated from the $Li^6(n,\alpha)H^3$ reaction in LiF crystals. Defects appear as cavities and platelets around ten Å in size and increase both with neutron dose and annealing temperature. For longer irradiations, metallic lithium precipitates out, in epitaxy with LiF lattice, and later, lithium salts appear due to the penetration of atmospheric gases through the cracks present in the damaged crystal. Various x-ray experiments followed the formation and evolution of these imperfections when their atomic concentration reached 10^{-4}. (auth)

8794 CRMet-893

Atomic Energy of Canada Ltd., Chalk River, Ont.
THE DIFFERENTIAL CALORIMETRY OF IRRADIATED UO_2 AND U_4O_9. B. G. Childs and J. McGurn. Dec. 1959. 14p. (AECL-963). AECL.

A study was made of the release of stored energy from neutron-irradiated uranium oxides at 50 to 750°C. The O/U ratios of the oxide specimens were 1.90, 2.00, 2.08, and 2.25 (U_4O_9) and the neutron exposures ranged up to 1.6×10^{19} n cm^{-2}. For UO_2 specimens no release of energy was detected while for U_4O_9 only a relatively small and barely significant release occurred in peaks at 150 and 660°C. The two-phase $UO_{2.08}$ specimens, in contrast, gave a significant release totalling 2.4 cal gm^{-1} at 340°C. It is suggested that this release of energy may be due to the reformation of the U_4O_9 phase regions following the displacement, during irradiation, of oxygen atoms into solution in the surrounding UO_2 matrix. (auth)

8795 HW-60908

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A REVIEW OF THE PROPERTIES OF ZIRCALOY-2. G. E. Zima. Oct. 14, 1959. 97p. Contract AT(45-1)-1350. OTS.

A comprehensive review of the qualifications of Zircaloy-2 and Zr as reactor core structural materials was made in 1954. (Bush, S.H. Properties of Zirconium and Zircaloy-2 and Alternate Reactor Structural Materials for the DPR, HW-33248.) A report of changes in the problem and confidence areas for Zircaloy-2 which were effected by laboratory data and operating experience subsequent to 1954 is presented. (J.R.D.)

8796 NP-8316

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
MONTHLY ACCESSION LIST 31 [ON RADIATION EFFECTS DATA]. Jan. 15, 1960. 19p. Project No. 2133. Contract AF33(616)-6564.

8797 REIC-Memo-20

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON RESISTORS AND RESISTOR MATERIALS. W. E. Chapin. Jan. 15, 1960. 31p. Project No. 2133. Contract AF33(616)6564.

The relative susceptibilities of fixed carbon composition, deposited carbon-film, metal-film, and precision wire-wound resistors to radiation damage are investigated. Hypotheses relating material damage and damage mechanisms to device performance are included along with recommendations for resistor selection. (J.R.D.)

8798 SCTM-400-59(16)

Sandia Corp., Albuquerque, N. Mex.
RADIATION TOLERANCE OF A SELECTED GROUP OF COAXIAL CABLES, PHASES I, II, AND III. P. F. Proulx, J. C. Drake, and S. E. Harrison. Jan. 18, 1960. 37p. OTS.

Experimental results on the effects of nuclear radiation in a group of coaxial cables are presented. The effects studied include changes in d-c insulation resistance, a-c breakdown voltage, and characteristic impedance after a given irradiation exposure. Phase and attenuation measurements were made before, during, and after irradiation. (auth)

8799

IRRADIATION OF URANIUM MONOCARBIDE. F. A. Rough, A. W. Hare, R. B. Price, and S. Alfant (Battelle Memorial Inst., Columbus, Ohio). Nuclear Sci. and Eng. 7, 111-21(1960) Feb.

Uranium carbide containing about 5.2 wt.% carbon was irradiated to nominal burnups of 1000 and 5000 Mwd/ton of carbide. Some cracking was observed. The observed density decreases were about the same at 1000 and 5000 Mwd/ton irradiations, being 0.7 to 2.5 and 0.6 to 2.5%, respectively. The effects of irradiation on surface damage, cracking, and density decrease are discussed. (auth)

8800

THE K-ABSORPTION SPECTRUM OF NEUTRON IRRADIATED NICKEL. D. Bally and L. Benes (Inst. of Atomic Physics, Bucharest). Nuovo cimento (10) 14, 1384-5(1959) Dec. 16. (In English)

Presented are the results from an investigation of the manner in which the K-absorption spectrum of nickel is modified when the integral irradiation flux of the absorber and the spectral composition of the incident beam are varied. Neutron irradiation causes a structural change in the K-absorption discontinuity of nickel. A comparison of results reveals that the observed modifications are caused by neutrons with energy above 0.7 ev. (B.O.G.)

8801

LOW-TEMPERATURE ANNEALING OF IRRADIATION-INDUCED DEFECTS IN LiF. D. A. Wiegand and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 116, 1069-80(1959) Dec. 1.

The expansion of alkali halides due to x-ray irradiation was observed at 90° and 300°K. Simultaneous measurements of the F band indicate that the expansion can be roughly explained on the basis of the generation of negative

ion vacancies. Partial annealing of the expansion of LiF at approximately 130°K after irradiation at 90°K is not accompanied by a decrease in the density of negative ion vacancies associated with F centers, indicating that the expansion cannot be completely due to the increase in the density of F centers. The low-temperature annealing of the expansion can be associated with either vacancy pair diffusion or interstitial motion. While experiments with plastic deformation and M band formation in LiF argue against vacancy pair diffusion, the spin resonance experiments of Känzig and Woodruff support the interstitial interpretation. It is therefore tentatively concluded that halogen vacancy interstitial pairs are generated by x-ray irradiation in LiF at 90°K and that the low-temperature annealing is due to a change in interstitial configuration. (auth)

8802

SUPERPARAMAGNETISM, NONRANDOMNESS, AND IRRADIATION EFFECTS IN Cu–Ni ALLOYS. F. M. Ryan, E. W. Pugh, and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 116, 1106-12(1959) Dec. 1.

The effect of neutron irradiation on copper–nickel alloys was investigated by means of magnetic susceptibility measurements. The susceptibilities were measured by the Guoy method between 300°K and 2.0°K for a series of alloys ranging from 17.22 to 46.5 at. % Ni. It is shown that without superparamagnetism an unreasonable magnetic moment per nickel atom has to be assumed. This model is confirmed by irradiation studies in which samples were exposed to neutron fluxes at the Brookhaven reactor, ranging up to 2.2×10^{19} neutrons/cm^2 while at 80°C, and the magnetic susceptibilities were found to increase following the irradiation. The increase was easily observable due to its strong temperature dependence, and was greatest for the samples with the highest nickel content and for samples exposed to the highest neutron fluxes. The susceptibilities of the alloys returned to their original values following an anneal in or above the temperature range where self-diffusion becomes important, while no changes in the susceptibilities were observed following anneals at lower temperatures. It is suggested that the copper–nickel system is not a perfect random solid solution but tends toward segregation, and that the neutron irradiation enhances diffusion toward a true equilibrium at room temperature. This is in agreement with several other observations. (auth)

PHYSICS

General and Miscellaneous

8803 AD-205682

University of Southern California, Los Angeles. PHOTOIONIZATION ANALYSIS BY MASS SPECTROSCOPY. Technical Report No. 21. G. L. Weissler, J. A. R. Samson, M. Ogawa, and G. R. Cook. Aug. 1, 1958. 51p. Contract Nonr-228(11).

A vacuum ultraviolet monochromator was combined with a mass spectrometer similar to previously reported instrumentation to study photoionization processes at 1570 to 430 A. Monochromatic photons were used to ionize Ar, He, Ne, O_2, N_2, CO, NO, CO_2, N_2O, and NO_2. Measurements of ion intensity as a function of photon energy were obtained for the parent ions together with their fragments. Dissociative ionization energies were also determined for some of the gases, and results for N_2O indicate a dissociation energy of 9.8 ev for N_2. (auth)

8804 AD-207205

Harvard Univ., Cambridge, Mass. Cruft Lab. CROSS-RELAXATION IN SPIN SYSTEMS. Technical Report No. 285. N. Bloembergen, S. Shapiro, P. S. Pershan, and J. O. Artman. Oct. 15, 1958. 43p. Contract Nonr-1866(28).

The energy transfer between adjacent resonances in nuclear and electron spin systems is analyzed in terms of the overlap of line-shape functions. The procedure is an enlargement of the original proposal of Kronig and Bouwkamp and consists of taking partial account of off-diagonal elements in the spin-spin interaction, which are omitted in Van Vleck's truncated Hamiltonian. If the frequency of these off-diagonal elements is sufficiently small, they give rise to an additional kind of spin-spin relaxation, observed by Gorter, et al. These off-diagonal elements are also responsible for cross-saturation effects in paramagnetic salts of the type observed by Townes, et al. An experiment on cross-saturation effects in paramagnetic salts by Giordmaine, et al., is described by spin-spin interactions, but not by the assumption of a hot phonon region as proposed by Gant. Implications of the cross-relaxation for the operation of solid state masers are discussed. (auth)

8805 AD-215505

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. THE USE OF BORON LOADED SILANE GLASS SCINTILLATORS FOR THERMAL NEUTRON DETECTION (thesis). Emory Neudeck Kemler, Jr. Feb. 1959. 47p.

Triphenyl-p-biphenylyl silane was loaded with 4 boron materials in an attempt to produce a boron loaded silane glass thermal neutron detector. The silane glass was made opaque by homogeneous addition of natural boron, boric acid, or borax. A sandwich scintillator using a natural boron filler was prepared, but thermal neutrons could not be detected. Scintillators loaded with triphenyl-borazole were transparent to visible light and produced a pulse peak for the alpha particle from the neutron-B^{10} reaction. Because of the scintillator's nonlinearity of response with energy, the gamma radiation produced by the neutron source could not be discriminated against. After short periods of exposure to thermal neutrons, internal disintegration of the triphenyl borazole loaded scintillators began. A satisfactory thermal neutron detector was not developed. Although the triphenyl borazole loaded scintillator produced an alpha peak, its gamma discrimination problem and lack of stability under radiation made it unsatisfactory. (auth)

8806 AD-215506

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. A TREATISE ON THE PRELIMINARY HAZARD SUMMARY REPORT FOR NUCLEAR FACILITIES (thesis). Gerald Bernard Connor. Mar. 1959. 120p.

A standardized routine and format are proposed for the writing of a preliminary hazards summary report for a nuclear facility. Each section of the suggested format is described in detail. What, why, and in what form items are to be included are discussed. (W.D.M.)

8807 AD-215508

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. SILVER ACTIVATION OF ZINC SULFIDE SINGLE CRYSTALS FOR SCINTILLATION COUNTING (thesis). Clyde Wilbur Moore. Mar. 1959. 52p.

The structure and bonding of zinc sulfide crystals are discussed. The theory of luminescence in zinc sulfide is discussed relative to the nature of activators and traps, radiative and non-radiative recombination at luminescent centers, and color of light emitted. The zinc sulfide crys-

tals were activated by surrounding the crystals with a mixture of zinc sulfide and silver sulfide powder and heating in an argon atmosphere at 800 to 1000°C for two hours. Activation caused an increase in the emission intensity with a shift in the wavelength of emissions from 4680 to ~4560 A with activation. The intensity decreased with increasing activation temperature. After activation, the green intensity band found in the unactivated crystal was not present. A blue luminescence with a wavelength of ~4560 A was produced when the crystals were excited with ultraviolet light. At 77.4°K two emission bands appeared at 4440 and 5600 A. When the crystals are used in a photomultiplier scintillation counter, large pulses are produced by alpha particles which may be counted by the electronic network. Higher activation temperatures produced larger pulses. Resolution was poor. (C.J.G.)

8808 AD-215509

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
SILANE GLASS AS A BETA AND GAMMA SCINTILLATOR (thesis). Robert Frank Cooper. Mar. 1959. 52p.

Some of the properties of triphenyl-p-biphenylylsilane were determined. This scintillator material, known as silane III, is a low melting (158°C), transparent, glassy solid. In comparing the scintillation characteristics of this scintillator with anthracene the following results were obtained: (1) its gamma detecting ability is slightly better than anthracene; (2) its relative scintillation efficiency is approximately 60% that of anthracene; (3) its light conversion efficiency is nearly equal to that of anthracene; and (4) its quantum efficiency of light conversion is equal to that of anthracene. Silane III exhibited excellent beta detection ability. The pulse height is decreased about 12% for each centimeter thickness of silane phosphor. (auth)

8809 AD-227017

Aerojet-General Corp. Ordnance Div., Downey, Calif.
HIGH SPEED CINEMICROSCOPY OF ELECTRICALLY EXPLODED TUNGSTEN AND MOLYBDENUM WIRES.
L. Zernow, G. Woffinden, and K. N. Kreyenhagen. [1959]. 23p. Contract DA-04-495-ORD-1407.

Presented at the Society of Photographic Scientists and Engineers 1959 National Conference, 26-30 October, 1959.

Advantages and limitations of cinemicroscopy techniques for recording exploding wire phenomena are discussed. The technique was found to be capable of obtaining otherwise inaccessible information. Occurrence of unduloid droplet breakup was observed in W and Mo, and it was noted that the formation of striations is related to the interaction of bubble-like formations on the wire rather than to increased evaporation rates in the constructed area of the undulations. (J.R.D.)

8810 AECU-4675

Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDIES OF REACTOR CONTAINMENT. Monthly Technical Progress Report No. 32 covering Period: December 1, 1959 through December 31, 1959. T. A. Zaker. Jan. 15, 1960. 4p. Contract AT(11-1)-528. OTS.

A summary of activity during the period is presented. A systematic series of tests was completed on shock crushing of reactor shield materials such as celotex, redwood, pine, balsa, foamglass, and a foamed plastic material. Investigations of explosive decompression of water resulting from pressure vessel rupture were continued. The shock tube system was successfully proof tested under long-time internal hydraulic pressure up to 1100 psi. A series of diaphragm rupture tests are described in which "petalling" was found to occur with a soft aluminum material sample. Soft copper diaphragm tests are also reported. Progress in other task areas was limited to report preparation. (For preceding period see AECU-4600.) (J.R.D.)

8811 AECU-4678

Pennsylvania State Univ., University Park. Crystal Research Lab. and Pennsylvania State Univ., University Park. Groth Inst.
A CRYSTALLOGRAPHIC LEAST SQUARES REFINEMENT PROGRAM FOR THE IBM 704: IDENTIFICATION PS XR3. V. Vand and R. Pepinsky. Oct. 1959. 140p. Contracts N6onr-26916; AF49(638)-416; and AT(30-1)-1516. OTS.

The crystallographic least-squares program PS XR3 for the IBM-704 performs an iterative procedure by adjusting unknown parameters, in this case the atomic co-ordinates X_i, Y_i, and Z_i of a given crystal structure and the isotropic temperature factor B_i of individual atoms, until the calculated structure factors show best agreement with observed structure factors. The diagonal approximation of the least-squares method is employed and only the first linear terms of the Taylor expansion are used. The initial solutions must be approximately known and are supplied to the computer via the co-ordinate deck. The observed structure factors are supplied via a reflection deck which is written in FORTRAN. In correlating and re-scaling the calculated and observed data, the most efficient equations for all 230 crystallographic space groups are used. This part of the program is written in SAP. Operation procedure for the program is discussed and the listing of the input in FORTRAN and the main program in SAP are given. SAP listing of x-ray and neutron scattering curves and examples of test programs are contained. (C.J.G.)

8812 AECU-4685

Thompson Ramo Wooldridge Inc., Cleveland.
THE SNAP-II POWER CONVERSION SYSTEM. DYNAMIC ANALYSIS. TOPICAL REPORT NO. 3. David L. Deibel, Gene L. Mrava, and Kurt Seldner. Jan. 15, 1960. 96p. Project No. 562-007252-88. Contract AT-11-1-GEN-8. (ER-3911). OTS.

SNAP II is the designation for a nuclear auxiliary power unit, designed primarily for utilization in the WS117L satellite vehicle. The SNAP II system consists of a reactor heat source, a mercury Rankine engine, and an alternator. Dynamic analysis of the power conversion system was conducted utilizing a comprehensive analog computer simulation. Feasibility of a parasitic load control for numerous system disturbances was demonstrated. (auth)

8813 AECU-4686

Thompson Ramo Wooldridge Inc., Cleveland.
THE SNAP-II POWER CONVERSION SYSTEM. TOPICAL REPORT NO. 4. TURBINE DESIGN AND TESTING. Earnest N. Poulos and Edward R. Furman. Jan. 18, 1960. 73p. Project No. 562-137252-88. Contract AT-11-1-GEN-8. (ER-3896). OTS.

SNAP II is the designation for a 3 kw nuclear auxiliary power unit to be used in a satellite vehicle. The SNAP II system consists of a reactor heat source, a mercury Rankine engine, and an alternator. A two stage, full admission, axial flow turbine was chosen for this APU application. Design details and test results are presented. (auth)

8814 AECU-4687

Brigham Young Univ., Provo, Utah.
TIME VARIATION OF THERMODYNAMIC PARAMETERS OF A GAS IN THE REGION OF A SHOCK FRONT. Progress Report No. III. E. John Eastmond, Richard W. Hales, Gordon D. Hoyt, Ramon C. Baird, Pratip N. Ray Chowdhury,

and William J. Strong. Nov. 30, 1959. 59p. Contract AT(04-3)-67. OTS.

The original goal of this investigation was to compare the thermodynamic characteristics of the gases in and behind the shock fronts in gases at initial pressures in the millimeter range and to compare these characteristics in the geometries of single and double discharges. The shock fronts were not visible, so it was not possible, at these pressures, to get visual data from the shock front itself. The parameters giving the properties of the gases were calculated from the measured velocities of the contact surfaces. Measurements made with an image converter camera (which is still in the development stage) agree well with these made with a photomultiplier tube. Differences are observed between the front velocities in the cases studied. These are of the order of 3 to 15 per cent. Considering the nature of the shot to shot fluctuations in the discharges and the inductance variation between the single and double discharge cases, it is not possible to say that these differences represent a physical difference. The mathematical treatment which says that two equal strength colliding fronts behave the same way that a single front colliding with a wall behaves, has not been shown to be inadequate by this investigation. It was hoped that a stronger confirmation could be given to the theory, but the accuracy of the data does not warrant it. (auth)

8815 AEDC-TN-59-102

Arnold Engineering Development Center, Tullahoma, Tenn.

A METHOD OF FORMING CONTINUOUS EMPIRICAL EQUATIONS FOR THE THERMODYNAMIC PROPERTIES OF AIR FROM AMBIENT TEMPERATURES TO 15,000°K, WITH APPLICATIONS. Martin Grabau. July 1959. 40p. ARO Project No. 366945. Contract AF40(600)-800.

Presented at the meeting of the AGARD Wind Tunnel Panel, Aachen, Germany, September 21-23, 1959.

Automatic data reduction for arc-driven, hotshot-type wind tunnels which operate at high stagnation temperatures is examined. Pressure and density are used as the simplest independent variables. The thermodynamic functions $H\rho/p$, S/R, and $1/Z$ for air, plotted at constant density as a function of the logarithm of the pressure, were found to exhibit basically similar graphical type-forms at 200 to 15,000°K and densities of 10^{-4} to 10^{2} relative atmospheres. This basic type-form is closely approximated by segments of straight lines connected by transition functions which are asymptotic at both ends. It is shown that the Fermi-Dirac and Bose-Einstein functions serve as kernels of such transition functions, respectively, when a point of inflection enroute is or is not indicated. If a transition is considered as either a vertical or horizontal offset, the limiting offset is linear and becomes the numerator of the transition function. Any number of such transition functions can be superimposed by simple addition, thereby rendering it possible to write a continuous equation involving as many transitions as may be necessary. Corresponding constants in successive equations at constant density are expressed as functions of density. In the functions S/R and $1/Z$, instances are found in which a Fermi-Dirac-type transition in a certain domain at low densities is gradually converted into a Bose-Einstein transition at higher densities. The various transitions are also shown to be more directly correlated with the compressibility factor than with the temperature. By virtue of the stepwise construction of the equations, an error in any equation is easily corrected by mending the appropriate part without disturbing the equation as a whole. An effort is made to reproduce the tabulated data to within an average infidelity of one per cent or less. (auth)

8816 AERE-R-2979

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE USE OF MOIRE FRINGES FOR SEMI-AUTOMATIC WAVELENGTH MEASUREMENT. L. Bovey. Dec. 1959. 15p. BIS.

The problem of wavelength measurement for large numbers of lines and methods used for its solution are discussed. A description is given of the manner in which standard Ferranti fringe counter equipment can be used with a Hilger measuring microscope and a Creed reperforator to record the results of wavelength measurements on tape for subsequent calculation by electronic computers. (auth)

8817 AERE-R/M-181

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

FLUX AND SLOWING DOWN MEASUREMENTS WITH A DISC SOURCE. J. G. Tyror. Oct. 1958. 19p. BIS.

Solutions of the diffusion and age equations for a disk source are compared with those for a point source. The differences indicate that the use of point kernels in conjunction with small disk sources involves errors of the order of at most a few per cent in slowing down distances. (auth)

8818 AFCRC-TR-59-142

Pittsburgh. Univ. Radiation Lab.

THEORETICAL STUDY OF THE PRODUCTION OF SECONDARY DISPLACED ATOMS DURING IRRADIATION. Final Report. J. R. Townsend. Apr. 17, 1959. 10p. Contract AF19(604)-3459. (AD-215067). OTS.

Calculation of the interaction potential has not been completed. The Fermi-Thomas atomic model was applied to obtain the charge density for three internuclear separations, but the solutions were unsatisfactory as evidenced by the poor normalization of the charge. It is believed that the excess electronic charge of at least 5% has resulted from an incorrect treatment of a singular point introduced by the coordinates. This minor change is being made in the programs. (auth)

8819 AFOSR-TN-59-845

Avco Corp. Avco-Everett Research Lab., Everett, Mass.

THE PRODUCTION AND STUDY OF HIGH SPEED SHOCK WAVES IN A MAGNETIC ANNULAR SHOCK TUBE. Research Report 59. Richard M. Patrick. July 1959. 41p. Contract AF49(638)-61. (AD-225292).

A magnetic annular shock tube was used to produce magnetically driven shock waves with very high velocities. Experiments were carried out with this device with two magnetic field configurations ahead of the shock front. The first configuration had a magnetic field ahead of the shock front in the direction of motion of the shock. In the second configuration the magnetic field ahead of the shock had its principal component in the plane of the shock front and a small component in the direction of motion of the shock. The continuum radiation emitted by the shock-heated plasma was measured with photomultipliers. The use of probes to measure the change in the local magnetic field in the shock front was investigated. With the second configuration shock velocities in excess of 4×10^{7} cm/sec were measured in hydrogen. For these high speed shock waves, a shock thickness was obtained from measured rise times of the emitted visible radiation. These shock thicknesses are thinner than the mean free path in the shock-heated plasma, an observation which agrees with a theoretical prediction. (auth)

8820 AFOSR-TN-59-1292

Laboratoire Mediterraneen de Recherches Thermodynamiques, Nice.

REALISATION OF A MOLECULAR GUN OR COSMIC WIND TUNNEL. F. Marcel Devienne. Oct. 1959. 59p. Contract AF61(052)296.

The principles of a molecular gun, an apparatus by means of which it is possible to reproduce conditions to which a solid body moving at a cosmic speed in a rarefied gas is submitted, are described and discussed. The apparatus is based on the exchange momentum between two crossed beams, one of these being a molecular beam corresponding to an ordinary temperature, and the other an ion beam in which the ions are accelerated by a few to a few hundred volts. Calculations on the probabilities of collision between a high speed ion and a low speed molecule are given. A means is indicated by which only a slight dispersion of molecules may be obtained; so that the paths of the high speed molecules are not disturbed as a result of intermolecular collisions. The specifications of the ion beam are given and the manner in which the ions and the high speed molecules must be separated is discussed. Possible intensities of the high speed molecular beams, corresponding to a static pressure of 1/10 μHg and to a speed capable of attaining 20 to 30 km/s, are discussed. (auth)

8821 AFOSR-TN-60-165

Technion Research and Development Foundation Ltd., Haifa, Israel.

THE EFFECT OF AXIAL CONSTRAINT ON THE INSTABILITY OF THIN CIRCULAR CYLINDRICAL SHELLS UNDER EXTERNAL PRESSURE. Technical Note No. 1. Josef Singer. Sept. 1959. 21p. Contract AF61(052)-123.

The effect of axial elastic restraint on the instability of a circular cylindrical shell under hydrostatic pressure or under uniform lateral pressure, is analyzed by a Rayleigh Ritz approach. For the case of hydrostatic pressure the effect is calculated for a wide range of parameters and design curves are presented for the percentage increase in critical pressure. The analysis is carried out for restraints which are active from the beginning of loading and for such which come into action only at the onset of buckling, and the difference between these two types of restraint is shown to be very small. (auth)

8822 APEX-539

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

F_2 TWO-GROUP NEUTRON DIFFUSION PROGRAM. F. B. Smith. Aug. 1958. 69p. Contracts AF33(600)-38062 and AT(11-1)-171. OTS.

The F_2 Two-Group Neutron Diffusion 704 Digital Computer Program No. 19 requires 8198 words of storage. Normal operation is with the program on production operator program (POP) tape. The program tape assignments are (1) system tape, (2) data input, (3) output, (4) POP and program library, and (5) and (6) temporary storage. This program solves one-dimensional, two-group diffusion equations as difference equations in multi-region plane, cylindrical, or spherical geometry subject to two-group albedo-type boundary conditions at the outer boundaries. Fission density is improved with each iteration until the selected convergence criterion is met. If an external source is provided, the eigenvalue, k, is omitted. Output consists of reactivity, k, after each iteration, and converged values of fission density and fluxes at each lattice point. An adjoint or a one-group calculation may be requested. Problem time in seconds with tape used for input-output is 17.5 + 0.06 (number of compositions) + 0.07 (number of regions) + 0.88 (number of iterations). The program accepts a maximum of 100 lattice intervals, 50 sets of two-group constants, and 50 regions. The number of iterations may not exceed 50. (auth)

8823 ARF-4132-7

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

COLLAPSE LOAD OF A SPHERICAL CAP. P. G. Hodge, Jr. Nov. 1959. 60p. Contract AT(11-1)-528. OTS.

A piecewise linear yield condition is used to obtain upper and lower bounds on the collapse load of a spherical cap subjected to uniform internal pressure. Good agreement between the bounds is obtained for a simply supported cap; the agreement is less satisfactory when the cap is clamped. (auth)

8824 CNbib-1

Italy. Comitato Nazionale per le Ricerche Nucleari. Divisione Studi e Ricerche, Rome.

BIBLIOGRAFIA SULLA DIFFRAZIONE DEI NEUTRONI. (A Bibliography on Neutron Diffraction). G. Caglioti, A. Paoletti, F. P. Ricci, and M. Zocchi. May 1959. 29p.

A bibliography is presented with 278 references to the published literature. (T.R.H.)

8825 CRMet-868

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE STORAGE OF FISSION ENERGY IN THE STRUCTURE OF U_3O_8. B. G. Childs and J. McGurn. Dec. 1959. 41p. (AECL-944). AECL.

The release of stored energy over the range 50 to 700°C, from neutron-irradiated U_3O_8 has been studied, using a sensitive differential calorimeter. A major peak in energy release occurs at a temperature which varies, according to the neutron exposure, from 150°C for 6×10^{15} n/cm to 380°C for 1.1×10^{19} n/cm. The total energy released increases with exposure up to a saturation value of 25.5 cal/g at 1.4×10^{17} n/cm. These results are discussed in terms of a model in which a region of homogeneous and "saturated" disorder is associated with the passage of each fission fragment through the material. The volume of this region is, on the average, 2.7×10^{-16} cm^3. (auth)

8826 KAPL-M-WKA-15

Knolls Atomic Power Lab., Schenectady, N. Y.

CALCULATION OF ATTENUATION FACTORS AND PER CENT SIGNAL CHANGE FOR X-RAY VOID DETECTION METHOD IN THE LIMITING CASE OF LOW QUALITY MIXED PHASE WATER SYSTEMS. W. Kermit Anderson and Burton E. Eno. Jan. 11, 1960. 18p. Contract W-31-109-Eng-52. OTS.

The effects of container material and wall thickness, x-ray quantum energy, and water channel thickness on attenuation factors and per cent change in attenuation were examined in the region between zero and ten volume per cent voids for water in the neighborhood of 500°F. Results indicate that, if nucleate boiling effects are to be detected an optimum experiment will require thin-walled tubes of a metal of low atomic number probably no higher than that for aluminum. Energies at 0.015 to 0.02 Mev must be selected to produce adequate meter ranges. (auth)

8827 NP-8309

Nuclear Codes Group.

NUCLEAR CODES GROUP NEWSLETTER NO. 10. Dec. 1, 1959. 13p.

Compiled and Distributed by New York Univ. Atomic Energy Commission Computing and Applied Mathematics Center.

Meeting minutes, announcements, and by-laws of the Nuclear Codes Group of ANS are presented. (T.R.H.)

8828 NP-8345

Stanford Research Inst. Poulter Labs., Menlo Park, Calif.
STUDIES IN HYPERVELOCITY IMPACT. Final Report. G. D. Anderson. Dec. 7, 1959. 49p. SRI Project No. GU-1989. Contract DA-04-200-ORD-597.

Techniques were developed for accelerating individual microparticles to velocities near 4 mm/μsec. The methods by which their velocities may be measured and the craters that they produce are discussed. To obtain microparticles in the 100 mm/μsec range, jet charges have been employed and a method for selecting only the fastest jet particles is described. Craters produced by high velocity jet particles are discussed. It is found that in many metals the craters are quite hemispherical in shape and crater shape is relatively insensitive to velocity from about 2 to 12 mm/μsec. Craters in plastic and brittle materials are also described. A series of the jet producing charges used by the Ballistic Research Laboratories were tested for particle velocity distribution and the results are discussed. (auth)

8829 NP-8346

Pittsburgh. Univ.
DETECTION OF NEGATIVE IONS FORMED BY CHARGE TRANSFER. Technical Report No. 13 [on] CAPTURE-LOSS AND IONIZATION CROSS-SECTIONS OF IONS AND NEUTRAL PARTICLES. T. M. Donahue and F. Hushfar. Dec. 1959. 4p. Contract Nonr 624(06).

A mass spectrometer was constructed and designed to detect and identify whatever negative ions are formed in gases through which atomic hydrogen beams pass. Hydrogen ions occur at energies of 13 and 19 kev for the incoming atom of H_2. Hydrogen ions and O^- ions occur in water vapor and in air, and O^- is found in O_2. No negative ions of N, He, or Ar could be detected. In CO, to which most attention was paid, it has been found that the cross section for negative ion formation at the electron loss maxima occurring at 12, 13.75, and 16.29 kev are 4.6, 5, and 5.8 times as large as at the minimum which occurs at 14.34 kev and 3, 3.4, and 3.9 times as large the much less pronounced minimum at 17.42 kev. (W.L.H.)

8830 NP-8352

Brooklyn. Polytechnic Inst.
ELECTROMAGNETIC THEORY OF D. C. EFFECTS IN FERROMAGNETIC RESONANCE. Technical Report No. 7. H. U. Juretschke. Jan. 1, 1960. 23p. Contract Nonr-839(06).

A theory was developed regarding the experimental aspects of the d-c effects accompanying ferromagnetic resonance. The strict proportionality of the amplitude to incident microwave power is predicted. The microwave behavior of thin films can be determined only if the added scattering in the film is either due to the film surfaces or to microscopic impurities. For very thin slabs the boundary conditions are satisfied to a high degree of approximation by an electric field which sets up an ohmic current density equal and opposite to the average value of the current density existing in a slab of infinite lateral extent. A discussion is presented which indicates that, in the whole range of Δ (film thickness) for which the inequality $\Delta \gg \frac{1}{2} k_0 S^2$ holds, the signal amplitude for large D is inversely proportional to Δ, so that the largest amplitude occurs for the thinnest films. It is concluded that d-c effects in ferromagnetic resonance depend directly on the local electromagnetic fields. (C.J.G.)

8831 NP-8354

Stanford Research Inst. Poulter Labs., Menlo Park, Calif.
PLANE WAVE GENERATORS. Technical Report 021-58. David E. Brink, Roy F. Hurst, and Milton C. Kells. Mar. 14, 1958. 14p.

Techniques for producing plane waves are discussed. Descriptions and applications of embedded cone, ellipsoidal lens, and flying plate plane wave generators and line generators are given. (C.J.G.)

8832 NP-8364

Westinghouse Electric Corp. Research Labs., Pittsburgh.
CROSS SECTION CALCULATIONS FOR FAST NEUTRON SCATTERING. PART V. OPTICAL MODEL TRANSMISSION COEFFICIENTS. Research Report 6-94511-6-R19. W. S. Emmerich. Apr. 29, 1958. 53p.

The optical model of the nucleus with a diffuse edge potential and surface absorption was used to compute $T_l(E)$, the nuclear transmission coefficients. These coefficients were defined through σ_{c_l}, the fast neutron cross section for formation of a compound system from the partial wave l. The real part of the potential consists of a constant spherical core of depth V_c and radius R_c to which a diffuse edge has been added of the form $V_c(e^x - x)^{-1}$, where $x = (r - R_c)/\tau$. The diffuseness of the edge is determined by τ. The imaginary part is taken to be zero in the core and λ times the derivative of the real part with respect to x in the surface region. The four parameters of the potentials, $\bar{R}$, τ, V_c, and λ, are contained in tables which cover a region of $\bar{R}$ from 4.0 to 8.2 in intervals of 0.3 (units of 10^{-13} cm). Representative graphs of T_l ranging from 0.01 to 1.00 are given as a function of energy from 0.1 to 100.0 Mev. Transmission coefficients are plotted as a function of the mean radius $\bar{R}$ for various neutron energies E. Calculations were performed by the SUMNUM code. (C.J.G.)

8833 ORNL-2774

Oak Ridge National Lab., Tenn.
WAVELENGTH TABLE OF RARE-EARTH ELEMENTS AND ASSOCIATED ELEMENTS INCLUDING ZIRCONIUM, THORIUM, HAFNIUM, RHENIUM, AND TELLURIUM. John A. Norris. Feb. 16, 1960. 739p. Contract W-7405-eng-26. OTS.

A table of wavelengths of the rare-earth elements and several associated elements was compiled for the use of spectroscopists. Data on the elements Zr, Hf, Th, Re, and Te are listed. A descending order of wavelength number is the basic format of the table. Included also are data on intensity and wave number. (auth)

8834 PPL-121

Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N. Y.
THEORETICAL STUDIES FOR A PROBLEM IN ELECTROMAGNETICALLY INDUCED DETONATIONS. W. Chinitz, K. M. Foreman, and L. W. Levin. Nov. 30, 1959. 90p. Contract AF49(638)-552. (AFOSR-TN-60-85).

The aerothermochemistry of electromagnetically driven gaseous detonations is formulated, initially, as a one-dimensional standing-free detonation problem. The revisions necessary to transpose the formulation to a moving-forced detonation, supported by a magnetic piston, are detailed. The numerical approximation techniques of programming for the non-linear equations for automatic digital computers are discussed. A method of computing enthalpy, heat of formation, and the equilibrium constant from experimental data is outlined. These three quantities are tabulated for 16 reactions, involving hydrogen, oxygen, nitrogen, and argon at 100 to 24,000°K. The results of a parametric study of standing oxy-hydrogen and air-hydrogen detonations are graphically presented and discussed. (auth)

8835 PR-P-43

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PHYSICS DIVISION PROGRESS REPORT [FOR] JULY 1, 1959 TO SEPTEMBER 30, 1959. 76p. (AECL-954). AECL.

Studies of gamma rays following capture of thermal neutrons in the elements from hydrogen to gallium, except oxygen and the noble gases, are reported. A few of the heavier elements such as lead and bismuth were also studied. The neutron beam from the NRX reactor and associated equipment are used to implement the studies. The angular correlation of two successive gamma rays is reported, and detailed studies of neutron capture in Nd^{143}, Gd^{155}, and W gave information on the nuclear level schemes with energies, spins, and parities. Measurement of the capture gamma ray from deuterium was also made. Distortion of the nucleus beyond its elastic limit during fission is being studied. A study of the thermal neutron induced fission of U^{235} revealed a hitherto unobserved fine structure in the prompt mass yield curve. This corresponds to one observed in the mass yield curves obtained by radiochemical methods after neutrons are emitted from the fragments. The fine structure is intimately connected with the occurrence of closed tightly-bound shells (50 to 82 nucleons) in the structure of certain fragment nuclei. Energy changes and angular distribution of slow neutrons scattered by crystals were used in measurements of dispersion for the lattice vibrations of NaI at 110°K. These measurements were made for the three symmetric crystal directions. A model based on a simplified polarizable ion was also developed and is used to describe much of the experimental data. Similar measurements were made on lead at 110°K to its melting point. The results show the existence of non-negligible forces between atoms out to fifth neighbors. A principle of magnetic focusing of charged particles is being studied by numerical methods. The $C^{14}(p,n)N^{14}$ and $C^{14}(p,\gamma)N^{15}$ reactions show interference between two $\frac{1}{2}^+$ states in the compound nucleus N^{15} at a proton energy of about 1.3 Mev. The interfering pair have different isotopic spin T. One level ($T = \frac{3}{2}$) is believed to be the analogue of the ground state of C^{15} and one ($T = \frac{1}{2}$) has no analogue in C^{15}. This observed mixture can be accounted wholly as due to the coulomb perturbation which introduces an asymmetry in the otherwise charge-independent nuclear forces. Work continued on several projects aimed toward development of transistor units for reactor control. Two general purpose read-out systems, one using relays and the other transistors, were developed and applications are being studied. Development of printed circuit cards for fast-slow coincidence experiments continued. Fast transistor amplifiers with band widths about 80 Mc/sec, and double delay-line amplifiers for use in the slow channels were tested. (For preceding period see PR-P-42.) (J.R.D.)

8836 RM-2400(RAND)

RAND Corp., Santa Monica, Calif.

A PARAMETRIC STUDY OF CERTAIN LOW-MOLECULAR-WEIGHT COMPOUNDS AS NUCLEAR ROCKET PROPELLANTS. I. HYDROGEN. F. J. Krieger. June 30, 1959. 40p.

The results are presented for hydrogen which, with its high specific impulse, is theoretically the most efficient nuclear rocket propellant. However, its physical properties (e.g., low boiling point and low specific gravity) present formidable logistic and design difficulties. Other compounds, such as lithium hydride (LiH), ammonia (NH_3), water, and methane (CH_4) are inferior to hydrogen in specific impulse, but have compensating physical characteristics. Under certain conditions, they may be more desirable than hydrogen as nuclear rocket propellants. (auth)

8837 RM-2402(RAND)

RAND Corp., Santa Monica, Calif.

A PARAMETRIC STUDY OF CERTAIN LOW-MOLECULAR-WEIGHT COMPOUNDS AS NUCLEAR ROCKET PROPELLANTS. III. WATER. F. J. Krieger. July 31, 1959. 42p.

Although hydrogen, with its high specific impulse, is theoretically the most efficient nuclear rocket propellant, its physical properties (e.g., low boiling point and low specific gravity) present formidable logistic and design difficulties. Other compounds, such as lithium hydride (LiH), ammonia (NH_3), water (H_2O), and methane (CH_4) are inferior to hydrogen in specific impulse, but have compensating physical characteristics. Under certain conditions, they may be more desirable than hydrogen as nuclear rocket propellants. This particular research memorandum presents the results for water. (auth)

8838 RM-2403(RAND)

RAND Corp., Santa Monica, Calif.

A PARAMETRIC STUDY OF CERTAIN LOW-MOLECULAR-WEIGHT COMPOUNDS AS NUCLEAR ROCKET PROPELLANTS. IV. LITHIUM HYDRIDE. F. J. Krieger. Aug. 28, 1959. 41p.

Although hydrogen, with its high specific impulse, is theoretically the most efficient nuclear rocket propellant, its physical properties (e.g., low boiling point and low specific gravity) present formidable logistic and design difficulties. Other compounds, such as lithium hydride (LiH), ammonia (NH_3), water (H_2O), and methane (CH_4) are inferior to hydrogen in specific impulse, but have compensating physical characteristics. Under certain conditions, they may be more desirable than hydrogen as nuclear rocket propellants. The results for lithium hydride are presented. (auth)

8839 RWD-RL-156

[Ramo-Wooldridge Corp., Los Angeles].

THRUST MULTIPLICATION BY SUCCESSIVE ACCELERATION IN ELECTROSTATIC ION PROPULSION SYSTEMS. David B. Langmuir and Bernard R. Cooper. [1959]. 9p.

Properties of idealized electrostatic propulsion systems are considered in which the motion of the charged particles and the variations of potential in the beam occur solely along one direction, taken as the axis, and in which the ions are transmitted without loss through equipotential accelerating planes. It is noted that numerous practical difficulties are associated with these concepts; however, the opportunities for thrust multiplication and for the achievement of low aspect ratios provide the incentive for further research. (J.R.D.)

8840 SC-4376(TR)

Clevite Research Center, Cleveland.

REPRESENTATION OF PIEZOELECTRICITY ON A THERMODYNAMICALLY INVARIANT BASIS—A PRELIMINARY REVIEW. Numerical Applications. Hans G. Baerwald. Feb. 24, 1959. 69p. OTS.

Reprinted at Sandia Corp., Nov. 1959.

Piezoelectricity is represented in thermodynamically invariant description as phenomen relating to two distinct forms of reversible energy density present simultaneously. This is largely irrelevant to, and basically simpler than, the customary tensorial description. Each piezoelectric crystallographic class is in general associated with three eigen coupling factors and associated principal strain-

stress and field-displacement component sets, representing stationary values of the radio: elasto-dielectric to self-elastic-dielectric energy density. Depending on crystallographic symmetry, some eigen coupling factors may be zero or equal to each other. The absolutely largest factor is characteristic of the optimum capability of the medium to transduce electromechanical power. (auth)

8841 SCTM-367-59(14)
New Mexico State Univ., University Park. Physical Science Lab. and New Mexico State Univ., University Park.
CYLINDRICAL ANTENNA THEORY. R. H. Duncan and F. A. Hinchey. July 31, 1959. 105p. OTS.

A Fourier series solution of Hallén's integral equation is developed in such a way that the Fourier coefficients are the unknowns in a system of linear equations. The elements of the matrix of coefficients are given by a highly convergent series. Numerical results are obtained for half and full wavelength antennas with half length to radius ratios of 60 and 500π. These results are in quite close agreement with the King-Middleton iterative solutions. A general review of existing theories is included. (auth)

8842 TPI-79
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
COLLISION DISTRIBUTION OF FAST NEUTRONS LEADING TO FAST FISSION IN A NATURAL URANIUM ROD. S. A. Kushneriuk. July 1955. 18p.

The collision distribution of fast neutrons leading to fast fission in a U rod is calculated under the assumption that the contribution to fast fission due to neutrons back scattered from the moderator surrounding the rod and to those inelastically scattered within the rod is negligible. (W.L.H.)

8843 UCRL-5842-T
California. Univ., Livermore. Lawrence Radiation Lab.
CONVERGENCE OF THE QUASI-CHEMICAL METHOD FOR THE ISING SQUARE LATTICE. Stephen G. Brush. Jan. 1960. 6p. Contract W-7405-eng-48. OTS.

The "quasi-chemical" approximation of Guggenheim was applied to the calculation of thermodynamic properties of the Ising model for a square lattice. The coefficients m_{ij} were computed for the square lattice of 0.41421 for all squares up to 6×6. The results show that the convergence of the quasi-chemical method is extremely slow. (C.J.G.)

8844 USNRDL-TR-381
Naval Radiological Defense Lab., San Francisco.
INVESTIGATIONS ON THE RELATIVE BETA-TO-GAMMA-RAY SENSITIVITY OF PHOTOGRAPHIC EMULSIONS. E. Tochilin and R. Golden. Oct. 27, 1959. 16p.

The dosage sensitivity of two conventional dosimeter films was found to be 10% greater for $Sr^{90}-Y^{90}$ and U beta rays than for Co^{60} gamma rays when an equivalent amount of energy was expended in the emulsion. These differences did not appear when a nuclear emulsion was substituted for the dosimeter films. Results are explained on the basis of the inherent grain sensitivities of the different emulsions. (auth)

8845 WADC-TN-59-110
Wright Air Development Center. Electronic Components Lab., Wright-Patterson AFB, Ohio.
ELECTROLUMINESCENCE: A SELECTED BIBLIOGRAPHY. [Period covered] March 16, 1959 to March 28, 1959. Philip K. Trimble. Apr. 1959. 14p. Project No. 4155. (AD-213601). OTS.

A bibliography of 90 references on electroluminescence is given. The references pertain to theoretical aspects of electroluminescence and studies of ZnS and other zinc compound phosphors which exhibit electroluminescence. (C.J.G.)

8846 ZPH-033
Convair, San Diego, Calif.
THE FLOW ABOUT A CHARGED BODY MOVING IN THE LOWER IONOSPHERE. R. R. Hunziker. Apr. 1, 1959. 31p. (AD-227131).

The flow about an electrically charged body traveling at high speeds through the lower ionosphere is analyzed. A simple gas model composed of electrons, ions, and neutral particles is used and the hydrodynamic description given is based on Maxwell's transfer equations for a mixture. The conditions under which local statistical equilibrium can be assumed are discussed and different approaches to determine the gasdynamic force in the subsonic, supersonic, and hypersonic cases are indicated. The reciprocal action of the electric field of the flow on the body is also analyzed and a formula for the resultant electric force is given. The total force on the body is equal to the sum of the gasdynamic force and the electric force. The negative potential acquired by a plane body is also calculated. Finally, the lack of validity of Debye's linearization in this case and the solution of the external nonlinear problem which characterize the electric potential and the electron distribution are discussed. (auth)

8847 AD-161760
THE OPERATION OF A PROTON TUBE. (Sul Funzionamento di un Tubo a Protoni). T. Franzini. Translated by Evro Layton and John Miller from Atti. accad. Lincei, Classe sci. fis., mat. e nat. (6) 27, 292-7(1938). 10p.

The design and operation of an apparatus which induces proton emission from hot palladium are given. The effects of a small magnetic field introduced between the tube and the antinode of the "proton diode" are discussed. Causes of the proton emission are discussed. (auth)

8848 AWRE-Trans-U-55
SOURCES OF SHORT X-RAY BURSTS FOR THE INVESTIGATION OF RAPID PROCESSES. V. A. Tsukerman (W. A. Zuckermann) and M. A. Manakova (Manakowa). Translated by W. E. Jones from Zhur. Tekh. Fiz. 27, 391-403(1957). 12p.

X-ray tubes with anodes in the form of needles are used for the investigation of processes which take place with a velocity of 1000 to 5000 meters/sec. Vacuum breakdown of a simple two electrode interspace by an impulse voltage of 1000 to 2000 kv is employed in the apparatus. The minute dimensions of the effective focus enable clear x-ray photographs to be obtained of rapidly moving objects with a duration of the x-ray burst equal to 1.5 to 2.5×10^{-7} sec. Designs were worked out for a quadruple and eight-fold radiography of successive development phases of a process. (W.L.H.)

8849 AWRE-Trans-U-61
CONCERNING CERTAIN METHODS OF MASS-MANUFACTURE OF Po–α–Be NEUTRON SOURCES. G. S. Komaishko, V. (B.) I. Matvienko, V. M. Permyakov, E. S. Soobbotin, and O. G. Feofilov. Translated by W. E. Jones from Atomnaya Energ. 5, 64-7(1958). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 108.

8850 NP-tr-342
AN EXPERIMENT IN PRODUCING REACTION THRUST IN A LABORATORY MODEL OF AN ION ENGINE. (Translation). Yu. Ya. Stavisskii (Stavisskiy), I. I. Bondarenko, V. I. Krotov, S. Ya. Lebedev, V. Ya. Pupko, and E. A. Stumbar. [1958]. 9p. OTS.

A method for accelerating ions is discussed. Electric reaction motors based on ion acceleration should consist of an ion source, an accelerating system, and a system for compensating the volumetric charge of an escaping beam of ions. Investigation of an ion engine is also discussed. The surface ionization phenomenon of cesium on tungsten was used. The ionization took place on a tungsten plate with an area of 70 cm^2 heated to 900°C by a tungsten emitter. Under test conditions, the rated thrust of the engine was 0.66 g. (J.R.D.)

8851

CALCULATION OF THE DEGREE OF POLARIZATION OF RESONANCE FLUORESCENCE WITH THE OCCURRENCE OF RADIATION DIFFUSION. [PART] I. R. Seiwert and W. Ermisch (Institut für Optik und Spektroskopie Deutsche Akademie der Wissenschaften, Berlin). Ann. Physik (7) 5, 4-14(1959). (In German)

If the resonance fluorescence radiation within the resonance tube is reabsorbed, then a depolarization occurs because of the directional-dependent radiation and absorption of the π and σ lights. Further depolarization is produced by the anomalous Zeeman effect, so that most of the π and σ emitted light is excited by π and σ light. Equations were derived for calculation of the degree of polarization of resonance fluorescence by very weak magnetic fields and weaker reabsorption of the resonance radiation. (tr-auth)

8852

CALCULATION OF THE DEGREE OF POLARIZATION OF RESONANCE FLUORESCENCE WITH THE OCCURRENCE OF RADIATION DIFFUSION. [PART] II. R. Seiwert and W. Ermisch (Institut für Optik und Spektroskopie, Deutsche Akademie der Wissenschaften, Berlin). Ann. Physik (7) 5, 15-30(1959). (In German)

The equations of part I for calculation of the degree of polarization, having been derived with regard to radiation scattering, were applied in three cases for which experimental results are submitted. The results obtained agreed with the experimental results as well as possible considering the necessary simplification of the calculation. The fact that the depolarization for very low particle densities is actually produced by radiation scattering can be considered as verification. (tr-auth)

8853

RESEARCH ON INVERSION OF SPIN VECTORS IN CHARGED 180° BLOCH WALLS. Ch. Greiner (Inst. für Magnetische Werkstoffe, Deutsche Akademie der Wissenschaften, Jena, Ger.). Ann. Physik (7) 5, 57-69(1959). (In German)

On the basis of experimental results research was conducted for a charged 180° Bloch wall of lamellar configuration on the inversion of magnetization vectors with the assumption of uniaxial anisotropy. For three characteristic methods of inversion the charge distribution, wall thickness d_0 and energy density E for the specified Bloch wall were calculated. These quantities, d_0 and E, are discussed with respect to the angle which the magnetization makes with its track in the Bloch wall for two different ratios of magnetostatic energy to anisotropy energy. (tr-auth)

8854

AN ABSOLUTE MEASUREMENT OF THE ROENTGEN. L. Argiero and A. Rindi (Corso per le Applicazioni Mediche dell'Energia Nucleare, Leghorn). Minerva nucleare 3, 391-8(1959) Dec.

After an examination of the possible methods of measurement, a theoretical study of an absolute measurement with Co^{60} by means of a free air ionization chamber with parallel-plate electrodes was made. The ionization loss of the Compton electrons, which ionize out the chamber was calculated. By the measurement of the current generated from the ions collected in the chamber, it is possible to obtain the ionization loss and thus the absolute dose. (auth)

8855

PHOTOGRAPHIC DOSIMETRY OF X RAYS, GAMMA RAYS, AND NEUTRONS. M. Ladu (Comitato Nazionale per le Ricerche Nucleari, Rome). Minerva nucleare 3, 399-405 (1959) Dec. (In Italian)

A survey is given on the photographic dosimetry of X, γ rays and neutrons, pointing out the advantages and limitations of the method. Mention is given to calibration, to the causes of errors, and to the proceedings by which an acceptable response for the personnel security can be obtained. (auth)

8856

ANGULAR DEPENDENCE OF X-RAY AND BREMSSTRAHLUNG SPECTRA OF THICK ANTICATHODES AT 29 MEV. Walter G. Mayer and E. A. Hiedemann (Michigan State Univ., East Lansing). Naturwissenschaften 47, 55(1960) Feb.

A study was made of the angular dependence of x-ray and bremsstrahlung spectra from thick anticathodes. An 0.184 mm thick square Pt anticathode was placed in the vacuum vessel of the 35-Mev betatron along with a 50 μ Al foil. The Al foil spreads out the electron beam before it reaches the anticathode. Energy distribution curves were obtained for 0° and 2.6°. The quotient of the activity ratios for the two angles was (Acu/Ac at 2.6°)/(Acu/Ac at 0°) = 1.032 ± 0.005. This result is apparently a confirmation of the angular dependence of the spectra and also shows the importance of this effect in studies of photonuclear processes. (T.R.H.)

8857

ION-OPTICAL PICTURES WITH RADIOACTIVE RECOIL PARTICLES. [PART] I. Sylvester Stühmer (Technische Hochschule, Munich). Nukleonik 2, 1-7(1960) Jan. (In German)

A study was made of magnified pictures of charged-particle-emitting surfaces. First, the surfaces of Kunsmann ion sources were portrayed greatly magnified on a fluorescent screen. Then, a new type of radiograph was attempted. Surfaces with radioactive deposits were radiographed by the low-energy recoil nuclei instead of the high-energy natural particle radiation such as α and β. (tr-auth)

8858

ION-OPTICAL PICTURES WITH RADIOACTIVE RECOIL PARTICLES. [PART] II. Hans Alexander Willax (Technische Hochschule, Munich). Nukleonik 2, 7-20(1960) Jan. (In German)

In conjunction with the experiments on producing ion-optical pictures by means of recoil particles from Th emanation deposits as described in part I (Stühmer, Sylvester Nukleonik 2, 1, p.1(1960)), the recoil yield was measured by ion-optical images. It is shown that positively charged recoils from β decay of ThB to ThC as well as positively and negatively charged ThB and ThC atoms, produced from the so-called "aggregate recoil," make these ion-optical pictures possible. The yields of recoil atoms and ions are strongly dependent on the material of the surface activated by ThB + C, on the preliminary treatment, on the loading time in the ThEm atmosphere, and on the storage time after loading. On the basis of the results, an explanation is given for the aggregate recoil

effect and the simultaneously observed occurrence of very low-energy α recoils. Altogether the results indicate that, with the presence of active deposits of ThEm on solid surfaces, an effect similar to that of cathode sputtering is exerted which must be attributed to the α-recoil atoms from ThC and ThC′ decay. (tr-auth)

8859

COHERENT SCATTERING OF 2.62-Mev PHOTONS BY ELECTRONS OF THE K SHELL OF MERCURY. H. Corniille and M. Chapdelaine (Ecole Normale Supérieure, Paris). Nuovo cimento (10) 14, 1386-90(1959) Dec. 16. (In French)

A theoretical calculation was made of Rayleigh scattering by K-shell electrons and of Thomson nuclear scattering. These results were used to interpret experimental results on photon coherent scattering at 2.62 Mev by lead. The difference between the theoretical and experimental curves is not discussed. However, it is stated that there is too large a variation between 30 and 70° to explain scattering by L electrons, nuclear resonance, and experimental errors. It is suggested that it is a case of the Delbruck effect which offers an important contribution at this energy. (tr-auth)

8860

VELOCITY OF SOUND IN LIQUID He^3 AT HIGH PRESSURES. K. R. Atkins and H. Flicker (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 116, 1063-5(1959) Dec. 1.

The velocity of 14-Mc/sec sound in liquid He^3 was measured at pressures up to 9 atmospheres in the temperature range 1.2 to 3.2°K. A few measurements were also made in the gas just above the critical temperature. A possible phonon contribution to the thermal coefficient of expansion of the liquid is discussed. (auth)

8861

EFFECTS OF POLARIZED LIGHT ON PHOTOCURRENTS AND PHOTOVOLTAGES IN ZnS. G. Cheroff, R. C. Enck, and S. P. Keller (IBM Corp., Poughkeepsie, N. Y.). Phys. Rev. 116, 1091-3(1959) Dec. 1.

The anomalous short circuit photocurrents in ZnS were measured using polarized light. In spite of the fact that for a given wavelength, light polarized perpendicular to the c axis is more strongly absorbed than light polarized parallel to the c axis, there are wavelength regions in which the absolute magnitude of the short circuit photocurrents are smaller for perpendicularly polarized light. The data are consistent with a double valence band model. (auth)

8862

RELATIVE MEASUREMENT OF THE PHOTODETACHMENT CROSS SECTION FOR H^-. Stephen J. Smith and David S. Burch (National Bureau of Standards, Washington, D. C.). Phys. Rev. 116, 1125-31(1959) Dec. 1.

The spectral dependence of the photodetachment cross section for the negative ion of atomic hydrogen was measured in the range from 4,000 to 13,000 A with approximately 300-A resolution. Measurements were made with twenty-five band pass filters, each measurment taken relative to the value obtained with a control filter at 5280 A. A probable error of about 2% is attached to the relative value obtained for each filter. The results are in significant disagreement with available calculated cross sections. (auth)

8863

SAUTER THEORY OF THE PHOTOELECTRIC EFFECT. U. Fano and James R. Albers (National Bureau of Standards, Washington, D. C.) and K. W. McVoy (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 1147-56 (1959) Dec. 1.

Results of Sauter are expressed in the form of a transition matrix which determines the photoelectric effect cross section for arbitrary x-ray polarization and arbitrary initial and final orientations of the electron spin. The structure of the matrix elements accounts for curious properties of the cross section in terms of interference between orbital and spin currents. Expansion of the wave functions into powers of Z/137 simplifies the calculation of the transition matrix, reduces it to a special case of the bremsstrahlung theory in Born approximation, and explains discrepancies between results of earlier calculations. Analytical and graphical data are given on the photoemission of polarized electrons by circularly polarized x rays. (auth)

8864

BREMSSTRAHLUNG AND THE PHOTOELECTRIC EFFECT AS INVERSE PROCESSES. Kirk W. McVoy (Brookhaven National Lab., Upton, N. Y.) and U. Fano (National Bureau of Standards, Washington, D. C.). Phys. Rev. 116, 1168-84 (1959) Dec. 1.

The bremsstrahlung matrix element at the short-wavelength limit of the spectrum is calculated to lowest order in $\alpha \equiv Z/137$, for an unscreened Coulomb field. The result, valid for relativistic incoming electrons, is shown to be exactly $\alpha^{-1}m^{-\frac{1}{2}}$ times the complex conjugate of Sauter's relativistic matrix element for the K-shell photoelectric effect. These matrix elements are the leading terms in an expansion of the exact matrix elements in powers of α, and they are found to be derivable from the first two terms of the expansions in powers of α of the electron wave functions. In this sense their structure is completely analogous to that of the Bethe-Heitler bremsstrahlung matrix element. This simple relation between the matrix elements derives from an approximate equality (through first order in α) between the Coulomb wave functions for bound and zero-momentum continuum states, which can be understood as due to the neglect of the Coulomb binding energy, a second-order quantity in α. The range of validity of Sauter's approximation is examined in detail. The lower bound of this (energy) range is found to be simply related to the radius of convergence of the expansion of the photoeffect matrix element in powers of α. (auth)

8865

ELASTIC SCATTERING OF O^{16} FROM NUCLEI. J. A. McIntyre, S. D. Baker, and T. L. Watts (Yale Univ., New Haven). Phys. Rev. 116, 1212-20(1959) Dec. 1.

O^{16} nuclei were elastically scattered from Au^{197}, Ni (natural isotope abundance), Al^{27}, and C^{12} at a laboratory energy of 158 Mev. The angular distributions obtained show features similar to those obtained for alpha particles scattered from various nuclei. However, diffraction effects are evident for target nuclei of higher atomic number Z with the alpha particle as the bombarding nucleus than with O^{16} as the bombarding nucleus. A survey of the literature is presented to show that diffraction effects become evident for $\eta \lesssim 5$, where $\eta \equiv ZZ'e^2/\hbar v$. (auth)

8866

PRECISION DETERMINATION OF THE HYPERFINE STRUCTURE OF THE GROUND STATE OF ATOMIC HYDROGEN, DEUTERIUM, AND TRITIUM. L. Wilmer Anderson, Francis M. Pipkin, and James C. Baird, Jr. (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters 4, 69-71(1960) Jan. 15.

A determination of the hyperfine structure of the ground

state of atomic hydrogen, deuterium, and tritium was made. A 1-Mc/sec output of an Atomichron was multiplied in a Gertsch AM-1 and used to phase lock the Gertsch FM-4 at a high frequency. The hyperfine transitions were driven by a radar jamming oscillator and beat with output of the Gertsch FM-4. This beat frequency (3 to 4 Mc/sec) was amplified, compared in a phase-detecting circuit, and counted with an electronic counter. The pressure shift of the buffer gases (argon, neon, and helium) was determined. Hyperfine splitting data were obtained by extrapolating to zero pressure. (C.J.G.)

8867

MEAN LIGHT YIELD FROM SCINTILLATORS. A. M. Ratner (Khar'kov All Union Scientific Research Inst. of Chemical Reagents). Pribory i Tekh. Ekspt. No. 5, 44-7 (1959) Sept.-Oct. (In Russian)

The ratio between the actual and calculated luminescence yields is analyzed. Calculations are made of the mean light yield from a cylindrical scintillator with arbitrary light absorption coefficients, reflection coefficients, and relative diffraction index at the border between the scintillator and photomultiplier. (tr-auth)

8868

PREPARATION AND PROPERTIES OF LARGE VOLUME SCINTILLATION PLASTIC MASSES. G. A. Kirdina and N. K. Pereyaslova (Inst. of Applied Geophysics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 5, 47-51 (1959) Sept.-Oct. (In Russian)

Preparations of large polystyrene phosphors, up to 10 l in volume, are described and their properties are analyzed. (tr-auth)

8869

THE CRYOGENIC LABORATORY OF THE NATIONAL INSTITUTE OF NUCLEAR PHYSICS, FRASCATI. Giorgio Careri (Università, Padua) and Giancarlo Moneti and Jörg Reuss (Kammerlingh-Onnes Laboratorium, Leida, [Italy]). Ricerca sci. 29, 1593-1603(1959) Aug. (In Italian)

The structures and plants of the cryogenic laboratory connected with the 1-Bev Electron Synchrotron of the I.N.F.N. are briefly described. The activity in the field of low-temperature physics, the supply of liquid helium to other research laboratories, the manufacture of liquid hydrogen, deuterium and helium targets for experiments with the synchrotron are illustrated. (auth)

8870

LIQUID HELIUM-3. J. G. Daunt (Ohio State Univ., Columbus). Science 131, 579-85(1960) Feb. 26.

The properties of liquid He^3 were investigated and compared with those of helium-4. It was found that helium-3 differs from helium-4 not only in its mass but also in possessing a nuclear spin of $\frac{1}{2}$. (B.O.G.)

8871

EFFECTS OF INFRARED LIGHT IN POST ILLUMINATION EXCITATION OF ZnS—Cu Sm. Ju-tung Shui, Jui-min Wuan, Ko-i Chuang, and Mei-juan Huang (Inst. of Physics, Academia Sinica, Peking). Wu Li Hsüeh Pao 15, 550-8 (1959) Oct. (In Chinese)

The influence of excitation intensity and infrared light on the damping curve, parameter α, luminosity J, in ZnS—Cu—Sm phosphors was investigated. The variations of α and J following day-light excitation at various conditions are analyzed. The mechanism of damping parameter changes induced by infrared light was determined. (tr-auth)

8872

MAGNETIC INTERACTIONS OF FREE RADICALS AT VERY LOW TEMPERATURES AND IN STRONG MAGNETIC FIELDS. Warren E. Henry (U. S. Naval Research Lab., Washington, D. C.). p.FV1-11 of "The Fourth International Symposium on Free Radical Stabilization: Trapped Radicals at Low Temperatures, Held at Dunbarton College, Washington, D. C., August 31, September 1 and 2, 1959." Washington, D. C., National Bureau of Standards, [1960].

An investigation of the magnetization of the free radical diphenyl picryl hydrazil was performed in magnetic fields up to 60,000 gauss and at temperatures in the liquid helium range. For a sample of pure crystals, with only moderate packing, the magnetization was dependent only on H/T and approached saturation with a Brillouin dependence for S = 0.5 and g = 2. Another sample, formed under a pressure of 10,000 lb per $in.^2$, exhibited indications of magnetic interactions through departures from Brillouin behavior, i.e., the magnetic moment isotherms do not superpose. The intrinsic magnetization in the second sample was small and the saturation range approached 0.11 Bohr magneton per free radical. (auth)

8873

SUPERFLUIDITÉ ET ÉQUATION DE TRANSPORT QUANTIQUE. (Superfluidity and the Quantum Transport Equation). Monographie No. 6. I. Prigogine. Brussels, Institut Interuniversitaire des Sciences Nucléaires, [1959]. 71p.

The properties of liquid He are described and discussed, and explanations of these characteristics are made on a phenomenological basis. The second part is devoted to a molecular description of the phenomena in the framework of a very simple model. This model is a gas of dilute hard spheres which obey Bose-Einstein statistics. In the last part it is shown how one can deal with the problem of transport phenomena at low temperatures. (T.R.H.)

8874

IMPROVEMENTS IN OR RELATING TO NEUTRON GENERATORS. (to Philips Electrical Industries, Ltd.). British Patent 828,600. Feb. 17, 1960.

A neutron source is described. Ions of D and T are produced by heating a Zr helix. These ions are accelerated toward a gold foil in which D and T have been adsorbed. The resulting D-D and D-T collisions produce neutrons. (T.R.H.)

Cosmic Radiation

8875

THE UNUSUAL COSMIC RAY EVENTS OF JULY 17—18, 1959. B. G. Wilson, D. C. Rose, and M. A. Pomerantz (National Research Council, Ottawa). Can. J. Phys. 38, 328-31(1960) Feb.

Intensity increases in cosmic rays on July 17 and 18, 1959, as observed at five stations in Canada and at Thule, Greenland, are reported. Intensity variations in the nucleon and meson components at the stations are noted. A Forbush decrease was observed on July 17. (C.J.G.)

8876

MOMENTUM SPECTRUM OF COSMIC RAYS AT SEA-LEVEL. F. Ashton, G. Brooke, M. Gardener, P. J. Hayman, D. G. Jones, S. Kisdnasamy, J. L. Lloyd, F. E. Taylor, R. H. West, and A. W. Wolfendale (Univ. of Durham, Eng.). Nature 185, 364-5(1960) Feb. 6.

Preliminary results are given of the differential momentum spectrum of μ mesons in the cosmic radiation measured 200 ft above sea level. The spectrum is used to make an estimate of the production spectrum of the

parent π mesons. The slope of the sea level μ-meson spectrum was observed to increase continuously with momentum. (C.H.)

8877

MOMENTUM SPECTRUM AND POSITIVE EXCESS OF μ-MESONS. J. Pine, R. J. Davisson, and K. Greisen (Cornell Univ., Ithaca, N. Y.). Nuovo cimento (10) 14, 1181-1204(1959) Dec. 16. (In English)

The absolute spectrum and positive excess of cosmic-ray μ-mesons near sea level were measured in the range 2 to 175 Bev/c. The magnetic spectrometer and the method of data reduction are described in detail. The integral spectrum was compared with the range distribution in the earth, and the agreement indicates that there is no serious error in the theoretical expression for the rate of energy loss. The π-meson production spectrum was computed and found to fit a power law with exponent -2.64. Also the spectrum of the pion positive excess was obtained, which is related to the pion production by primary protons in their first collisions. It is concluded that at 10^{12} ev per nucleon, most of the primary cosmic-ray energy is carried by protons, and that the proportion of their energy given to pions in a single interaction is in the neighborhood of 10%. (auth)

8878

THE STUDY OF COSMIC RAY VARIATIONS WITH NUCLEAR EMULSIONS. C. J. Waddington (Univ. of Bristol, Eng.). Nuovo cimento (10) 14, 1205-16(1959) Dec. 16. (In English)

It is shown that the density of ending particles observed in nuclear emulsions exposed at high altitudes is related to the primary cosmic ray flux. Because this is a parameter which is readily determined it is suggested that its use is particularly appropriate for studying temporal variations of the primary radiation. The necessary corrections for background particles are established, and preliminary applications illustrated. A value is obtained for the exponent of the primary energy spectrum during solar maximum, and relations derived relating this parameter to the flux of primary cosmic ray α-particles. (auth)

8879

INVESTIGATION OF A HIGH ENERGY ELECTRON-PHOTON CASCADE IN EMULSION. E. Fenyves, A. Frenkel, and F. Telbisz (Central Research Inst. of Physics, Budapest) and J. Pernegr, V. Petržílka, J. Sedlák, and J. Vrána (Physical Inst., Czechoslovak Academy of Sciences, Prague and Charles Univ., Prague). Nuovo cimento (10) 14, 1249-53(1959) Dec. 16. (In English)

A photon initiated high energy electron-photon cascade was investigated. The energy of the primary photon was determined from the longitudinal development and the lateral distribution of the cascade to be about 2.10^{12} ev. The energy spectrum of electron pairs generated on the first 1.5 cascade units was measured. The spectrum obtained does not deviate significantly from either the spectrum calculated by the Bethe-Heitler theory or from that calculated by Migdal extending the Landau-Pomeranchuk-Ter-Mikaelyan theory. (auth)

8880

AN EXPERIMENT TO INVESTIGATE THE EXISTENCE OF CHARGED PARTICLES OF MASS ~550 m_e. N. Durga Prasad, M. G. K. Menon, and O. P. Sharma (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 14, 1332-41(1959) Dec. 16. (In English)

Evidence suggesting the existence of charged particles of mass ~550 m_e was reported by Alikhanian, Šostakovič, Dadaian, Fedorov, and Deriagin. A search was made for these particles in a photographic emulsion stack exposed for five months at an altitude of 11,000 ft, $\lambda = 24°N$ at Khillanmarg (Kashmir). The central plate of the stack was scanned for all tracks, with dip angles $< 45°$, due to particles brought to rest within it. A total of 5,790 tracks was obtained in this scan. Of these tracks, 2,613 were due to particles, with ranges < 5 mm, emerging from nuclear disintegrations; these were not considered further. Mass measurements were carried out on the remaining 3,177 tracks by the grain density vs. residual range method; the range interval involved is $(3 \div 40)$ g/cm^2. The 3,177 tracks investigated were found to be due to 1,018 μ-mesons, 168 π-mesons and 1,991 particles of mass $\geq$ 850 m_e. No particle with a mass estimated to be between 390 m_e and 850 m_e was observed. Five such particles are to be expected on the abundance of ~½% compared to μ-mesons (in the same range interval) quoted by Alikhanian et al. The question of the existence of such particles is discussed in the light of this and other experiments. (auth)

8881

SIZE-SPECTRUM OF EXTENSIVE AIR SHOWERS OF THE COSMIC RADIATION. I. RESPONSE OF A SINGLE SCINTILLATOR TO EXTENSIVE AIR SHOWERS. J. R. Green (Univ. of New Mexico, Albuquerque). Nuovo cimento (10) 14, 1342-55(1959) Dec. 16. (In English)

Previously determined experimental and theoretical expressions for the lateral distribution of particles in extensive air showers are used to predict the response of a single scintillator to these showers. The integral rate of particles traversing the scintillator is found in terms of the integral rate of showers; the average size of shower resulting in a given number of particles through the scintillator is calculated; the effect of the zenith-angle distribution of the shower axes is investigated. (auth)

8882

SIZE-SPECTRUM OF EXTENSIVE AIR SHOWERS OF THE COSMIC RADIATION. II. EXPERIMENTAL RESULTS FROM A SINGLE SCINTILLATOR. J. R. Green and J. R. Barcus (Univ. of New Mexico, Albuquerque). Nuovo cimento (10) 14, 1356-65(1959) Dec. 16. (In English)

The operation and calibration of a single scintillator of area 7.3 m^2 is discussed. The integral spectrum of particles passing through the scintillator at 1,575 m.s.l. has a logarithmic slope of $-(1.514 \pm 0.022)$; from this it is deduced that the integral spectrum of extensive air showers whose sizes lie in the range from 10^5 to 10^8 particles is given by $K(\geq N) = 3.2 \cdot 10^{-7} (N/10^6)^{-1.514}$ m^{-2} s^{-1} sr^{-1}. Smaller events are identified with stars produced locally in the toluene of the scintillator; the integral spectrum of such events dissipating E Mev in the scintillator is given by $R(\geq E) = 4.5 \cdot 10^2 E^{-2.78}$ min^{-1}/g of toluene. (auth)

8883

HIGH ALTITUDE NEUTRON INTENSITY DIURNAL VARIATION. Robert C. Haymes (New York Univ.). Phys. Rev. 116, 1231-7(1959) Dec. 1.

Two balloon flights in which boron-trifluoride neutron counters were carried aloft were launched from Brownwood, Texas, during September 1958. The flights attained altitudes of 86,000 and 79,000 feet at a conventional geomagnetic latitude of 41°N. They showed that the slow-neutron intensities in the atmosphere had decreased by about 12% since the time of minimum solar activity in 1954. They also show that this decrease was mainly in the low-energy end of the spectrum, as the mean free path for absorption had increased from 180 ± 25 g/cm^2 to 240 ± 30 g/cm^2. A high-altitude decrease apparently associated with the geomagnetic storm of September 25, 1958 was detected.

After achieving altitude, the balloons floated at a constant elevation through sunset. A sharp peak in the intensity which occurs just before sunset at balloon altitudes was detected on both flights. The origin of this phenomenon, which results in a doubling of the intensity for about 25 minutes, is unexplained, although some possible mechanisms are discussed. (auth)

8884

SEA-LEVEL COSMIC-RAY MASS SPECTRUM IN THE INTERVAL $30m_e$–$2000m_e$. G. G. Fazio (Massachusetts Inst. of Tech., Cambridge) and M. Widgoff (Harvard Univ., Cambridge, Mass. and Brown Univ., Providence). Phys. Rev. 116, 1263-6(1959) Dec. 1.

In nuclear emulsion stacks exposed to sea-level cosmic radiation under 180 g cm^{-2} of iron, no evidence for mass values in the regions $30m_e$ to $100m_e$ and $400m_e$ to $900m_e$ was found. If such particles do exist, their intensity relative to that of μ mesons stopping in the same range interval must be as follows: for $30m_e$ to $100m_e$, $\leq 13\%$; for $400m_e$ to $900m_e$, $\leq 0.04\%$. (auth)

8885

SEARCH FOR ANOMALOUS LIFETIME VALUES IN SEA-LEVEL COSMIC RADIATION. G. G. Fazio and D. M. Ritson (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 116, 1267-9(1959) Dec. 1.

By use of a scintillation counter telescope, sea-level cosmic radiation was investigated for the existence of particles of mass greater than $60m_e$ decaying with lifetimes in the millisecond region. If such particles exist, their intensity, relative to μ mesons, for various lifetime ranges, must be as follows: for 10^{-4} to 10^{-2} sec, $\leq 0.03\%$; for 10^{-4} to 5×10^{-2} sec, $\leq 0.1\%$; for 10^{-4} to 10^{-1} sec, $\leq 0.14\%$; for 10^{-4} to 10^{-1} sec (for decay into a light meson), $\leq 0.03\%$; for 10^{-4} to 1.0 sec, $\leq 1.4\%$. (auth)

8886

PROTON FLUX DURING THE GREAT AURORA OF 3–4 SEPTEMBER 1959. Donald E. Osterbrock (Univ. of Wisconsin, Madison). Science 131, 353-4(1960) Feb. 5.

Photoelectric measurements of the Hβ intensity from the aurora observed on September 3–4, 1959, show that it continued to increase after a corona formed, and reached a maximum as the corona broke up into rays, decreasing rapidly to nearly zero within the next 10 minutes. The maximum flux of protons incident on the earth during the aurora, deduced from these measures, was at least 1.4×10^8 auroral protons per square centimeter, per second. (auth)

Elementary Particles

8887 AECU-4664

Illinois. Univ., Urbana and Institute for Advanced Study, Princeton, N. J.

THEORY OF PION SCATTERING AND PHOTOPRODUCTION. Geoffrey F. Chew. [1956]. 150p. OTS.

The Yukawa theory of pion production and scattering is discussed. Recently discovered metastable hyperons and K particles are considered as not falling within the domain of this theory. These heavier particles do exist and do strongly interact with the pion–nucleon system. Energies are limited mostly to below 1 Bev and nucleons are mostly treated non-relativistically. Pions, because of their smaller mass, are given a completely relativistic treatment. The general features of the Yukawa theory are discussed first, then a non-relativistic approach to meson–nucleon scattering is outlined, followed by a relativistic discussion of the same problem. Photomeson production is treated similarly. Finally, theory and experiment are compared to evaluate the status of the Yukawa theory. (T.R.H.)

8888 AFCRC-TR-59-123

Air Force Cambridge Research Center. Propagation Sciences Lab., Bedford, Mass.

FUNDAMENTAL PARTICLES. Paul J. Nawrocki. Mar. 1959. 32p. Project No. 5633. (AD-212072).

A vast majority of mathematical disciplines pertinent to nuclear physics have explicitly or implicitly postulated an infinite universe of point particles. A different interpretation of nucleons, beta decay, and mesons, consistent with Eddington's concept of a finite universe composed of only two species of fundamental particles, is presented. (auth)

8889 AFOSR-TN-59-842

Uppsala Univ. Inst. of Physics.

A $_{\Lambda}H^4$ HYPERFRAGMENT EMITTED FROM AN ANTIPROTON CAPTURE STAR. Technical Note No. 4. A. G. Ekspong, Å. Frisk, and B. E. Ronne. [1959]. 10p. Contract AF61(052)-13, Phase D.

The observation of a definite case of Λ hyperon emission from an antiproton annihilation in a heavy nucleus in nuclear emulsion is reported. The emulsion stack was exposed to a beam of 740 Mev/c antiprotons at the Bevatron. The Λ hyperon is emitted bound in a $_{\Lambda}H^4$ hyperfragment. From observational data one calculates a Λ binding energy of 2.6 ± 1.0 Mev. (auth)

8890 AFOSR-TN-60-25

Vienna. Universität. Institut Für Theoretische Physik.

THE SIGMA-NEUTRON INTERACTION. Scientific Note No. 2. G. Eder. Nov. 23, 1959. 5p. Contract [AF]61(052)-265.

The potential between a Σ-particle and a neutron due to exchange of pions is calculated in a static theory. Strangeness and isobaric spin conserving interactions are considered. Second and fourth order terms in the coupling constant are evaluated, and it is shown that the singlet spin potential is more attractive than the triplet spin potential. (J.R.D.)

8891 DP-446

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

A MONTE CARLO CODE FOR THE TRANSPORT OF NEUTRONS. William V. Baxter. Dec. 1959. 34p. Contract AT(07-2)-1. OTS.

A Monte Carlo code for the IBM 704 computer was written to study the transport of neutrons in a uniform heterogeneous lattice of cylindrical fuel assemblies. Models of the geometric and physical processes are used to obtain the neutron age and migration area; the flux as a function of position, energy, and direction; and absorption data from which thermal utilization and the multiplication constant k_∞ may be calculated. (auth)

8892 GA-1180

General Atomic Div., General Dynamics Corp., San Diego, Calif.

NEUTRON THERMALIZATION IN WATER. Mark Nelkin. Jan. 13, 1960. 11p. Project No. 48. Contract AT(04-3)-167. OTS.

Presented at the Winter Meeting of the American Nuclear Society at Washington, D. C., November 4–6, 1959.

Calculations of the neutron differential energy transfer cross section in water at 300°K based on a model of proton motions are presented. Using the formalism of Zemach and Glauber, approximate expressions for X were obtained from Fourier transforms between 0.2 and 0.8 ev. Calcula-

tions are presented on the total cross section as a function of energy, angular distribution, diffusion coefficient, and diffusion cooling coefficient. The neutron spectra in boric acid and cadmium sulfate solutions are compared to the measurements by Beyster. (C.J.G.)

8893 KAPL-M-ELW-11

Knolls Atomic Power Lab., Schenectady, N. Y.

INCREASING CONVERGENCE RATES BY TRANSFORMING THE MULTIGROUP OPERATOR—APPLICATION TO ONE SPACE DIMENSION PROBLEMS. E. L. Wachspress. Dec. 1959. 12p. Contract W-31-109-Eng-52. OTS.

A method for increasing convergence rates of fluxes in the usual group diffusion calculation by transforming the multigroup operator and estimating a value of ν_e such that $\nu_e < \nu_c$ is given. The method is applied to one space dimensional problems. (C.J.G.)

8894 LAMS-2360

Los Alamos Scientific Lab., N. Mex.

COORDINATE TRANSFORMATIONS IN INTRANUCLEAR CASCADE STUDIES. N. Metropolis, A. L. Turkevich, and R. L. Bivins. Sept. 1959. 19p. Contract W-7405-eng-36. OTS.

Spatial and Lorentz transformations employed in the treatment of the collision of two relativistic particles are presented. After the collision, inverse Lorentz transformations followed by a series of inverse rotations are used to describe the new vectors resulting from the collision in the laboratory system of coordinates xyz. The form chosen is suitable to numerical calculations and are applicable to intranuclear cascade studies. (C.J.G.)

8895 NP-8359

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

SCATTERING OF SLOW NEUTRONS BY NH_3-MOLECULES. Report No. 117/OFJ. J. A. Janik, J. Janik, and A. Wanic. Nov. 1959. 7p.

The scattering cross section vs. neutron energy was measured for the scattering of slow neutrons by gaseous ammonia. The results were in agreement with the theory of Krieger and Nelkin. (auth)

8896 ORINS-32

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.

RADIATION MEASUREMENTS AND THE SPECTRUM. Demonstration of the Effects of Scattering on the Radiation Spectrum. Marshall Brucer and Yoichiro Umegaki. Aug. 1959. 25p. OTS.

This report contains both the English and the Japanese version.

The effects of scattering on the radiation spectrum are demonstrated. Sources of Cs^{137}, Co^{60}, and mock-iodine were placed 40 cm from a crystal and the spectrum determined at 30, 20, and 10 cm above a water phantom on the surface of the water and at 10, 20, and 30 cm below the water level. An interpretation of the spectrum at primary, Compton scattered, and low energies was made. The relative difference spectrum of each source is discussed. (C.J.G.)

8897 S1C-1500-RS-133

Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.

COMPARISON OF NUMERICAL AND THEORETICAL SOLUTIONS OF THE MILNE PROBLEM FOR A HALF-SPACE AND A SLAB. E. Fein. Dec. 12, 1957. 11p.

The one-dimensional, one-velocity transport code (RDR-4) is found to give excellent agreement with analytically obtained results in a variety of cases. Some new expressions are given for the current leaving an isotropically scattering slab in vacuum and for the scalar flux on the vacuum surface which were used to check the code. (auth)

8898

SOME ASPECTS OF THE PROBLEM OF THE HEAVY UNSTABLE PARTICLES. N. Dallaporta (Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Acta Phys. Austriaca 13, 19-32(1960) Jan. (In English)

The decay processes, masses, spins, relative abundances, and lifetimes of the heavy unstable particles are summarized and discussed. Examples are given to illustrate the effects of the Gell-Mann and Nishijima strangeness selection rule for the particles. Strong interactions of these particles are discussed relative to conservation of strangeness. (C.J.G.)

8899

EXPERIMENT ON THE FINITE THEORY OF ELECTRONS. Otto Bergmann (Univ. of Alabama, Tuscaloosa). Acta Phys. Austriaca 13, 33-47(1960) Jan. (In German)

A classical relativistic theory of electrons was investigated. The theory contains no finite expression of any physical magnitude. The reaction energy of the radiation was omitted. According to this theory, a single electrical wave carries neither energy nor impulse, but the interaction of two or more electron waves creates both energy and impulse. A semi-classical theory of electrons is given as an illustration. (tr-auth)

8900

ON THE POSSIBILITY OF DETERMINING THE SPIN OF $_{\Lambda}H^4$ FROM THE ANGULAR DISTRIBUTION FOR MESONIC DECAY. D. Chlebowska and J. Szymański (Inst. for Nuclear Research, Warsaw). Bull. acad. polon. sci. Sér. sci., math., astron. et phys. 7, 643-9(1959).

An attempt was made to determine the spin of the $_{\Lambda}H^4$ hyperfragment from the analysis and angular distribution for the decay process $_{\Lambda}H^4 \rightarrow t + p + \pi$. (C.J.G.)

8901

A FIXED-SOURCE APPROACH TO SCATTERING OF KAONS, SUPPLEMENT. W. Królikowski (Inst. of Theoretical Physics, Warsaw Univ.) and (Inst. for Nuclear Research, Polish Academy of Sciences, [Warsaw]). Bull. acad. polon. sci. Sér. sci., math., astron. et phys. 7, 691-3(1959).

Corrections are made to equations for the separation of scattering amplitudes for different isospins T as given by Królikowski on a fixed-source approach to scattering of kaons. (C.J.G.)

8902

EFFECTIVE RANGE APPROXIMATION FOR SCATTERING OF KAONS WITH SCALAR COUPLING. W. Królikowski (Inst. of Theoretical Physics, Warsaw Univ.) and (Inst. for Nuclear Research, Polish Academy of Sciences, [Warsaw]). Bull. acad. polon. sci., Sér. sci., math., astron. et phys. 7, 695-7(1959).

Using the fixed-source approach and the effective range approximation, the scattering of kaons in the scalar case is discussed. The results suggest that the Yukawa coupling is pseudoscalar. (C.J.G.)

8903

RECENT DEVELOPMENTS IN NUCLEAR SCIENCE. L. Gilly (Université, Louvain, Belg.). Ind. chim. belge 25, 27-34(1960) Jan.

The discovery of the mesons and anti-particles is examined from the point of view of its contribution to our nuclear knowledge. It will be seen that although this contribu-

tion is positive in numerous fields, it nevertheless leaves many questions unanswered. (auth)

8904

THE QUESTION OF THE EXISTENCE OF (Λ°p), (Σ^{+}p) AND (Σ^{-}n) HYPERFRAGMENTS. R. C. Kumar (University Coll., London). Indian J. Phys. 33, 411-14(1959) Oct.

From the decay modes of (Λ°p), (Σ^{+}p), and (Σ^{-}n), a discussion is presented showing how these hyperfragments could be confused with other known particles in bubble chamber and nuclear emulsion experiments. (C.J.G.)

8905

LOW ENERGY ELASTIC SCATTERING OF NUCLEONS BY DEUTERONS. Shigueo Watanabe (Princeton Univ., N. J.). Nuclear Phys. 14, 429-37(1960) Jan. (1). (In English)

The elastic scattering of nucleons by deuterons at low energies is discussed. The interaction forces between two nucleons include the central exchange and spin-orbit forces. The inclusion of the two-body spin-orbit force, exchange forces, and the exclusion principle leads to a set of coupled integro-differential equations. The specification to the Yukawa shape for both central and spin-orbit forces is considered. (auth)

8906

ON THE CONVERGENCE OF THE BORN APPROXIMATION. H. Davies. Nuclear Phys. 14, 465-71(1960) Jan. (1). (In English)

It is shown that the Born series for the non-relativistic scattering amplitude f(k) by a spherically symmetric static potential V(r), which is bounded and has finite range, is convergent for all k if the potential $-|V(r)|$ cannot support a bound state. (auth)

8907

THE ELECTRIC DIPOLE SUM RULE. Geoffrey I. Opat (Univ. of Melbourne). Nuclear Phys. 14, 506-11(1960) Jan. (1). (In English)

A derivation of the electric dipole sum rule, in the form of Levinger and Beth, is given. A Schrödinger equation was employed and the transformations were carried out to internal or center-of-mass coördinates ξ_i and the coördinate of the center-of-mass x. Nuclear recoil was taken into account and redundant coördinates were eliminated. (C.J.G.)

8908

THE CREATION OF FAST ELECTRON PAIRS BY HIGH ENERGY MUONS. P. H. Stoker and P. C. Haarhoff (Univ. of Potchefstroom, Union of South Africa). Nuclear Phys. 14, 512-16(1960) Jan. (1). (In English)

The cross sections for the creation of fast electron pairs by cosmic muons in lead were calculated. A lower limit of 10 mc^2 was imposed on the energy of each electron of the pair. (auth)

8909

DISPERSION RELATIONS IN THE LEE MODEL. Paul de Celles and Gordon Feldman (Johns Hopkins Univ., Baltimore). Nuclear Phys. 14, 517-21(1960) Jan. (1). (In English)

The self energy and the wave function renormalization constant for the V particle in the Lee Model are calculated by technique of dispersion relations. The results agree with those obtained in the usual manner. (auth)

8910

THREE-FIELD THEORY OF STRONG INTERACTIONS. W. Thirring (Universität, Bern). Nuclear Phys. 14, 565-77(1960) Jan. (2). (In English)

A theory of strong interactions which uses only three massless fundamental fields is discussed. This theory gives all additive constants of the motion but not C and P separately. It is proved that the electric and pionic vertices have to conserve parity but not the vertices for β and strange particle interactions. It seems that the latter feature is not necessarily in contradiction with parity conservation in nuclear physics, in contrast with the opinion expressed in a previous paper on this question. Accepting the simplest representation for spin 0 bosons one finds that they are pseudoscalar rather than scalar inasmuch as parity is conserved. (auth)

8911

COMPLEX PHASE SHIFTS IN PROTON-PROTON SCATTERING. R. J. N. Phillips (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). Nuclear Phys. 14, 633-8(1960) Jan. (2). (In English)

The imaginary parts of the p–p phase shifts at 380 Mev are deduced from pion production data; their effect on elastic scattering appears to be negligible. Anomalies at the π^{+} + d threshold are also very small. (auth)

8912

THE THREE-BODY K-MESON DECAY. Jan Nilsson (Chalmers Univ. of Tech., Göteborg). Nuclear Phys. 14, 639-47(1960) Jan. (2). (In English)

A method for calculation of polarization states of relativistic Dirac fields is given and applied to the three-body K-meson decay. The matrix elements for these processes are given the most general form compatible with a V–A-interaction and relativistic invariance. As a consequence, the final expression for the transition probabilities includes two unknown functions to be determined from the experimental material. The analysis of the results available from different sources is still found insufficient for definite conclusions regarding the type of interaction. New possible tests of the V–A-theory are proposed. (auth)

8913

PSEUDO-CLUSTER EXPANSION. J. Fujita (Nihon Univ., Tokyo). Nuclear Phys. 14, 648-60(1960) Jan. (2). (In English)

The Ursell-Mayer cluster expansion method is extended to the case of a q-number model operator for either boson or fermion systems. The many-body problem for a system with strong, hard sphere interactions can be approximately reduced to that for a weakly interacting system without hard sphere interactions. The effective Hamiltonian for the weakly interacting system is given in the form of an expansion series quite analogous to the ordinary cluster expansion. The validity of this expansion method is discussed. It can be proved that the simplest case leads to the approximate Bethe-Goldstone equation (or Brueckner approximation). Formulas are derived expressing the total energy and the diagonal and non-diagonal matrix elements of operators by the asymptotic wave functions. Possibilities of application of this method are discussed. (auth)

8914

MAGNITUDE OF THE PION RENORMALIZATION CONSTANTS. John W. Moffat (RIAS, Baltimore). Nuclear Phys. 14, 682-4(1960) Jan. (2). (In English)

It was recently pointed out that within the exact formulation of renormalization theory the pion mass renormalization constant δm^2 for pion-nucleon coupling is either infinite or indeterminate. This result is shown to hold also in the case of pion-photon coupling. A detailed investigation reveals that for pion-nucleon coupling δm^2 is indeterminate only under very special circumstances. (auth)

8915

STATISTICAL ERRORS IN PARTICLE POLARIZATION

MEASUREMENTS. Edward J. Burge (King's Coll., London). Nuclear Instr. and Methods 6, 101-2(1959) Dec. (In English)

In the polarization of beams of particles from double scattering, the number scattered into a given infinitesimal solid angle is given by $N = N_0(1 + P_1P_2\cos\phi)$, where N_0 is the number scattered under the same conditions by an unpolarized incident beam, ϕ is the azimuthal angle between the plane of scattering and the plane of incident beam polarization, P_1 is the polarization of the incident beam, and P_2 is the polarization of the beam scattered from the second target. It is shown that the fractional error in P_1P_2 depends on the range of the angle ϕ accepted for a given scattering angle. A range of $\phi = \pm 20°$ is suggested as a maximum. (C.J.G.)

8916

MESONIC DECAYS OF HYPERFRAGMENTS. G. C. Deka (Univ. of Bristol, Eng.). Nuovo cimento (10) 14, 1217-25 (1959) Dec. 16. (In English)

A search for hyperfragments emitted from the nuclear interactions of 4.5 Bev π^--mesons and 300 Mev/c K^--mesons provided twenty-one decays of hyperfragments. Nine of these have been identified as specific hypernuclei from the momentum balance of the decay particles; their binding energies were measured and found to be in good agreement with the results obtained by other authors. (auth)

8917

HYPERFRAGMENTS PRODUCED BY K^- CAPTURE IN NUCLEAR EMULSION: π^0 DECAY MODES. R. G. Ammar (Univ. of Chicago). Nuovo cimento (10) 14, 1226-48(1959) Dec. 16. (In English)

A systematic study is presented of the π^0-decays of light hypernuclei ($A \leq 5$) produced by K^- capture in nuclear emulsion. Approximately 3.10^4 K^- stars were examined, yielding a total of 94 1-prong events satisfying the following conditions: $R_c \geq 5$ μm, 8 μm $\leq R_0 \leq 50$ μm, $\theta \geq 66°$, where R_c is the range of the primary (connecting track), R_0 that of the secondary (recoil), and θ the angle between their directions at their point of intersection. Of the 69 events which could be charge (Z) identified, 55 had Z = 1 and 14 Z = 2. In the Z = 1 category the true π^0-events could not be separated from 1-prong Σ^--events because of the overwhelming ($\geq$90%) contribution of the latter. It is concluded that probably all the 14 Z = 2 events represent true ${}_\Lambda He$ decays ($\sim$10 ${}_\Lambda He^4$ and $\sim$4 ${}_\Lambda He^5$). In addition, three 2-prong events were consistent with the interpretation as ${}_\Lambda He^4$ decays. One can define for the π^0-decays of ${}_\Lambda He^4$ the ratio: R' (${}_\Lambda He^4$) = (two-body decays)/(all decays − "unobservable" ones); the "unobservable" ones being π^0-neutron-recoil decays with recoil momenta < 110 Mev/c and other modes with $\geq$ 1 neutron. A value R' (${}_\Lambda He^4$) = $0.82^{+.15}_{-.18}$ is found here. The analogous quantity for ${}_\Lambda H^4$ was computed and yields $R'({}_\Lambda H^4) = 0.88^{+.07}_{-.09}$. These two numbers are equal within their experimental errors. This equality is consistent with the assumption $|p_-/s_-| = |p_0/s_0|$ as predicted by the $\Delta T = \frac{1}{2}$ rule. The ratio, ρ, of two body π^0-decays of ${}_\Lambda He^4$ to the total number of π^--decays of ${}_\Lambda He^4$ was determined to be 0.7 ± 0.4. Accordingly as the spin of ${}_\Lambda He^4$ is 0 or 1, ρ is a measure of the strength either of the s- or of the p-wave channel in the neutral mode of the free Λ decay. (auth)

8918

SEARCH FOR THE DECAY $\mu \to e + \gamma$ AND OBSERVATION OF THE DECAY $\mu \to e + \nu + \bar{\nu} + \gamma$. J. Ashkin, T. Fazzini, G. Fidecaro, N. H. Lipman, A. W. Merrison, and H. Paul (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 1266-81(1959) Dec. 16. (In English)

This paper reports a search for the $\mu \to e + \gamma$ mode of decay. The result is negative within the sensitivity of the experiment: the branching ratio we find is $(1.2 \pm 1.5) \cdot 10^{-4}$. Evidence is presented for the existence of the decay process $\mu \to e + \nu + \bar{\nu} + \gamma$. (auth)

8919

ANALYSIS OF K^- ABSORPTION IN DEUTERIUM. T. Kotani and M. Ross (Indiana Univ., Bloomington). Nuovo cimento (10) 14, 1282-1309(1959) Dec. 16. (In English)

A theoretical examination was made of the capture of K^- at rest by deuterium, principally in terms of final state YN interactions. In particular total rates were calculated, the momentum spectra associated with the production of $\Sigma^- + n + \pi^+$ and $\Lambda^0 + p + \pi^-$, and the corresponding angular correlation. (The latter are not found to be useful except perhaps as a check). On the basis of total rates it is known that capture from the P Bohr orbit through the s wave KN channel probably dominates. This assignment is reinforced by the spectrum of the low momentum Λ peak (Λ's converted from Σ's). A definitive check can be made when a somewhat better converted Λ spectrum is measured, since one should observe a double peak (with a cusp at the maximum pion momentum associated with production) if this assignment is correct. Analysis of the high pion momentum Λ peak (directly produced Λ's), using this assignment reveals that the spectrum is insensitive to the YN interaction and yet does not seem to agree with the data. This spectrum shape (and that for $\Sigma^-n\pi^+$) depends significantly on the KN → Yπ absorption process off the energy shell, which in turn depends on the KN scattering lengths. Preliminary comparison of data and theory indicates a large negative real part for the isotopic spin one KN scattering length. From the relative rate for conversion of Σ's into Λ's, a minimum value was deduced for the imaginary part of the isotopic spin ½ p wave ΣN scattering length. The result, larger than the pion Compton wavelength, indicates a very strong potential in the ΣN channel and/or coupling ΣN and ΛN channels, a potential much stronger than indicated by the universal pion baryon interaction. Capture from the S Bohr orbit is also extensively discussed. In this case, the spectra associated with Σ^- and direct Λ production are sensitive to the final YN interaction. (auth)

8920

THE $\mu \to e + \gamma$ DECAY AND THE INTERMEDIATE CHARGED VECTOR BOSON THEORY. Ph. Meyer and G. Salzman (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 1310-21(1959) Dec. 16. (In English)

The μ-e-γ vertex is calculated in the intermediate charged vector boson theory, as a function of the square of the four momentum of the photon. Consistency arguments show that the boson anomalous magnetic moment should be taken equal to zero. The result is then specialized to a real photon. The experimental branching ratio $\rho = (\mu \to e + \gamma)/(\mu \to e + \nu + \bar{\nu}) = (1.2 \pm 1.5) \cdot 10^{-4}$ fixes the cut-off value at less than one-fifth the intermediate boson mass. It is concluded that this theory does not reasonably account for the experimental data, no matter how massive the boson is assumed to be. (auth)

8921

THE K_{e4} AND $K_{\mu 4}$ MODES OF K-MESONS DECAY. V. S. Mathur (Univ. of Chicago). Nuovo cimento (10) 14, 1322-31(1959) Dec. 16. (In English)

The characteristics of the K_{e4} and $K_{\mu 4}$ modes of K-meson

decay were studied. Isotopic spin relationships following from the hypothesis of a $T = \frac{1}{2}$ strangeness-nonconserving current are discussed. The decay rates were estimated in several ways, which agree in predicting a K^+_{e4}/K^+_{e3} branching ratio between 10^{-3} and 10^{-4}, so that the observation of K^+_{e4} events may be expected in the near future. The $K^+_{\mu 4}$ rate is expected to be at least an order of magnitude smaller than that for K^+_{e4} mode of decay. (auth)

8922

ON THE PROBLEM OF POSSIBLE SPINS IN ELEMENTARY PARTICLES. F. Engelmann (Technische Hochschule, Munich). Nuovo cimento (10) 14, 1366-72(1959) Dec. 16. (In German)

It is shown that it is possible to formulate the phenomenological description of elementary particles in a way which allows the existence of particles of the spins 0, $\frac{1}{2}$, and 1 only. This restriction appears as a consequence of the fact that space-time is 4-dimensional. (auth)

8923

ELECTROMAGNETIC MASS SHIFT FOR SPINLESS PARTICLES. H. Katsumori (Osaka Gakugei Univ.). Nuovo cimento (10) 14, 1381-3(1959) Dec. 16. (In English)

The electromagnetic mass shift for spinless particles was discussed in order to explain the observed $\pi^\pm - \pi^0$ mass difference (9 m_e). The observed $K^\pm - K^0(\bar{K}^0)$ mass difference (−9 m_e) has the opposite sign and seems difficult to understand. It is pointed out that the K^0 may be heavier than the $K^\pm$ while the π^0 must be lighter than the $\pi^\pm$ in the e^2-order calculation of the electromagnetic self-energy, if the isospace transformation property of the electromagnetic form factor is taken into account following the Nishijima and Gell-Mann rule for the strangeness assignment. A more detailed discussion of this problem is to be reported. (B.O.G.)

8924

FIELD OPERATORS FOR BOSONS WITH IMPENETRABLE CORES. I. EQUATIONS WHICH REPLACE THE COMMUTATION RULES. A. J. F. Siegert (Northwestern Univ., Evanston, Ill.). Phys. Rev. 116, 1057-62(1959) Dec. 1.

Field operators representing particles with impenetrable cores cannot satisfy the usual commutation rules. While the customary derivation of the second quantization formalism cannot be applied to the case of particles with nonintegrable interaction potentials, the field operators $\psi(x)$ and $\psi\dagger(x)$ can be defined by a matrix representation which exhibits them explicitly as transformations of functions of N position vectors into functions of $N-1$ and $N+1$ position vectors, respectively. The assumption of impenetrable cores is introduced in this definition by taking the matrix elements which lead to prohibited configurations of position vectors equal to zero. Equations which replace the usual set of commutation rules are derived from this definition for the case of hard sphere interaction. Conversely it is shown that results which follow from the commutation rules in the standard formalism, follow from the new set of equations with the changes obviously required by the assumption of impenetrable spherical cores. For example, the operator for the number of particles in a finite domain has as eigenvalues the non-negative integers not exceeding the largest number of hard spheres which can be placed into the domain. (auth)

8925

HIGH-FREQUENCY LIMIT OF BREMSSTRAHLUNG IN THE SAUTER APPROXIMATION. U. Fano (National Bureau of Standards, Washington, D. C.). Phys. Rev. 116, 1156-8(1959) Dec. 1.

The expansion in powers of Z/137 utilized in the Sauter theory of the photoelectric effect yields a nonzero cross section proportional to Z^3 at the high-frequency limit of the bremsstrahlung spectrum, and also at the low electron energy limit of the pair production spectrum. These cross sections are related to the Sauter photoelectric cross section by detailed balancing. The results apply equally when the effects of spin orientations and x-ray polarization are considered. (auth)

8926

MULTIPLE MESON PRODUCTION IN NUCLEON-NUCLEON INTERACTIONS AT ENERGIES OF 10^{12} ev. Marcel Schein, D. M. Haskin, E. Lohrmann, and M. W. Teucher (Univ. of Chicago). Phys. Rev. 116, 1238-47(1959) Dec. 1.

A nuclear interaction of type 0 + 20p observed in nuclear emulsion was analyzed by measuring the energies and angles of the secondary particles. The primary energy, as determined from the angular distribution of the tracks, is 2.7×10^{12} ev. This value is in agreement with an independent estimate obtained from the total energy dissipated. A secondary collision of type 0 + 20n was also analyzed in the same way. Its energy is 1.4×10^{12} ev, which is comparable to the primary energy. The inelasticity of the primary event is $0.54^{+0.16}_{-0.15}$. The energy and angular distributions of the shower particles in the center-of-mass system (c.m. system) are given for both events. The shower particles show a correlation in the sense that those with the highest energies are emitted in the c.m. system under small angles with the shower axis. The energy distribution of the mesons in the c.m. system is peaked toward low energies and shows a remarkably long tail at high energies extending up to 10 Bev. One of these particles is a π^0 meson, which carries off about 23% of the total energy. The average value of the transverse momentum of the shower particles is 0.3 ± 0.05 Bev/c. (auth)

8927

MODIFIED ANALYSIS OF NUCLEON-NUCLEON SCATTERING. II. COMPLETED ANALYSIS OF p-p SCATTERING AT 310 Mev. Malcolm H. MacGregor, Michael J. Moravcsik, and Henry P. Stapp (Univ. of California, Livermore and Berkeley). Phys. Rev. 116, 1248-56(1959) Dec. 1.

The application of a recently suggested modified method of analysis of nucleon-nucleon scattering experiments to p-p scattering at 310 Mev was completed. The results are summarized and compared with the work of Gammel and Thaler and of Signell and Marshak. The analysis is carried out on several levels, with varying number of angular momentum states being described by phenomenological phase shifts while the higher angular momentum states are represented by the one-pion exchange contribution. It is found that the inclusion of the high angular momentum states in this manner makes a significant improvement in the analysis. The pion-nucleon coupling constant is also determined from the data with a fair accuracy. The five "best" sets of phase shifts of the conventional analysis are reduced to two sets, corresponding to Solution 1 and 2 of the conventional analysis. Some slight evidence favors Solution 1 over Solution 2. It is shown that a very satisfactory fit can be obtained with nine parameters instead of the 14 parameters of the conventional analysis. Some remarks are made about the extent to which Solutions 1 and 2 are distinct. Experiments are suggested which could resolve the remaining ambiguity due to the existence of two sets of phase shifts. (auth)

8928

APPLICATION OF SUM RULES TO ELECTRON-DEUTERON SCATTERING. J. I. Friedman (Stanford Univ., Calif.). Phys. Rev. 116, 1257-62(1959) Dec. 1.

A measurement of elastic and inelastic electron-deuteron scattering was made at a momentum transfer of 206 Mev/c and an electron energy of 175 Mev for comparison with the Drell-Schwartz sum rules. The measured value of the non-energy-weighted sum rule is in good agreement with theory. The experimental result for the energy weighted sum rule is 30% larger than the value given for a pure Wigner potential and is consistent with a Rosenfeld two-body interaction if the analysis is restricted to central forces. The analysis is extended to include tensor forces for comparison with the prediction of the Gartenhaus potential. It is found that the gage terms introduce major ambiguities when tensor forces are included. (auth)

8929

K^+-NUCLEON SCATTERING IN THE TAMM-DANCOFF APPROXIMATION. Grzegorz Białkowski and Andrzej Jurewicz (Warsaw Univ.). Phys. Rev. 116, 1269-71(1959) Dec. 1.

Calculations of K^+-nucleon scattering phase shifts are reported. A simple model of Yukawa interactions between K mesons and baryons (containing no derivates) is adopted. The method used is a three-dimensional Tamm-Dancoff approximation but with no simplifications as far as recoil effects are concerned. This method is particularly convenient for K^+-nucleon scattering, since the principle of associated production excludes graphs leading to nonrenormalizable effects. The resulting integral equation was solved for the T = 1, $S_{\frac{1}{2}}$, $P_{\frac{1}{2}}$, and $P_{\frac{3}{2}}$ states in the energy region up to 1.26 Bev. The coupling constant is the only parameter to be determined from experimental data. This was chosen to fit the experimental value of the total cross section at about 350 Mev. It turned out that the best agreement with experiment was obtained with $(G^2 + G^2)/4\pi = 12.5$. This value is much greater than the corresponding one adopted in previous papers. (auth)

8930

INTERACTION OF STATIC NUCLEONS. R. E. Cutkosky (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 116, 1272-84(1959) Dec. 1.

The Heitler-London method was applied to the calculation of the energy of interaction of two nucleons, as given by the fixed-source model. Numerical results are also given for the normalization of the state vector and the number of mesons in the cloud, for the states which comprise the deuteron. Particular attention is given to the rate of convergence of the expansions and the influence of the excited states of the nucleons. The relation to the Tamm-Dancoff method is also discussed in detail. It is shown that in T = 0 states, the interaction does not appear to differ in any significant way from the one-meson exchange term. In T = 1 states, on the other hand very large contributions are obtained from the higher order terms. These contributions have such a nature as to suggest that even at low energies it is improper to apply the fixed-source model, with the assumption that the meson cloud follows adiabatically the motion of the nucleons, to T = 1 states. (auth)

8931

EVALUATION OF DISPERSION RELATIONS. R. Blankenbecler (Princeton Univ., N. J.) and S. Gartenhaus (Purdue Univ., Lafayette, Ind.). Phys. Rev. 116, 1297-1305(1959) Dec. 1.

A new evaluation of the dispersion relations for mesonic phenomena is proposed. The method, which utilizes the comparison function procedure, makes explicit use of crossing symmetry and allows for an exact treatment of nuclear recoils. For the case of meson-nucleon scattering at low energies, an expansion of a first order solution is made in inverse powers of the nucleon mass and agreement with the results of a previous evaluation is obtained. The extension of the method to other processes is briefly discussed. (auth)

8932

PHOTOPRODUCTION OF π MESONS. S. Gartenhaus (Purdue Univ., Lafayette, Ind.) and R. Blankenbecler (Princeton Univ., N. J.). Phys. Rev. 116, 1305-11(1959) Dec. 1.

The dispersion relations for meson photoproduction at moderately low energies are examined by means of the comparison function method which was proposed in an earlier paper. Assuming that only the (3,3) state is appreciably modified by rescattering effects, an approximate solution is obtained. Nucleon recoil and crossing symmetry are treated exactly. The static limit of this solution yields substantial agreement with the results of Chew, Goldberger, Low, and Nambu. It is hoped that an evaluation including effects of nucleon recoil will improve the agreement in the resonance region. (auth)

8933

PIONIC DECAY MODES OF LIGHT Λ HYPERNUCLEI. R. H. Dalitz and L. Liu (Univ. of Chicago). Phys. Rev. 116, 1312-21(1959) Dec. 1.

Decay probabilities are calculated for pionic modes of decay of the Λ hypernuclei $A \leq 5$. An effect of the Pauli principle omitted in previous calculations for the two-body π^- and π^0 modes is now included. An estimate for the total decay probability of all π^- (or π^0) modes based on the completeness relation is checked by comparison with calculations based on detailed models of the decay process for two particular systems. The present data on ${}_\Lambda H^4$ decay are now consistent with either (a) spin J = 0 for any value p/s less than 1.5, or (b) spin J = 1 for any value p/s greater than 1.2, a much weaker conclusion than that reached previously. If the $\Delta T = \frac{1}{2}$ rule is roughly correct for Λ decay, the two-body mode $\pi^0 + \alpha$ will be prominent among ${}_\Lambda He^4$ decay modes. The π^0/π^- ratio will then be large (~1.5) for ${}_\Lambda He^4$ decay and small (~$\frac{1}{9}$) for ${}_\Lambda H^4$ decay, compared with the value ~$\frac{1}{2}$ for ${}_\Lambda He^5$ and ${}_\Lambda H^3$ decay. (auth)

8934

STRUCTURE OF WEAK INTERACTIONS AND UNWANTED PROCESSES. N. Cabibbo and R. Gatto (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Phys. Rev. 116, 1334-8(1959) Dec. 1.

A general discussion of the forbidden reactions such as $\mu \to e + \gamma$, $\mu \to e + e + e$, $\mu + N \to e + N$, $\mu \to e + \gamma + \gamma$, etc., which would arise from a possible nonlocal structure of the weak interactions is given. It is shown, by a canonical transformation, that the dominating terms of the structure, in an expansion in terms of the inverse of the average intermediate mass, do not contribute to any forbidden reaction. A discussion of the $\mu - e$ conversion process for a bound μ is given, and the rate is calculated for a particular model. (auth)

8935

PRODUCTION OF Σ^0 AND Λ HYPERONS BY Σ^- CAPTURE IN DEUTERIUM. Orin Dahl, Nahmin Horwitz, Donald Miller, and Joseph Murray (Univ. of California, Berkeley). Phys. Rev. Letters 4, 77-8(1960) Jan. 15.

The branching ratio for the reactions $(\Sigma^- + d \to \Sigma^0 + n + n)$ and $(\Sigma^- + d \to \Lambda + n + n)$ when Σ^- hyperons are captured at rest in deuterium was determined to be 0.037 ± 0.022; the $\Sigma^- - \Sigma^0$ mass difference is then > 3.53 Mev. It is con-

cluded that both the branching ratio and spectrum of the reactions can be understood in terms of a simple impulse model. (C.J.G.)

8936

TESTS OF CHARGE INDEPENDENCE OF NUCLEON-NUCLEON INTERACTIONS. G. Breit, M. H. Hull, Jr., K. Lassila, and K. D. Pyatt, Jr. (Yale Univ., New Haven). Phys. Rev. Letters 4, 79-81(1960) Jan. 15.

A test of charge independence in p−p and p−n interactions was performed using values of the unrenormalized coupling constants g_0^2 derived from the one-pion exchange potential (OPEP) by other authors. Charge independence of the OPEP was indicated. In a second test, the n−p non-OPEP phase parameters corresponding to T = 1 were varied from their p−p values which were initially used in gradient searches for T = 0 parameters. From the second test it is concluded that possibly charge independence is only approximate, with violations of the order of 2 times the uncertainties in phase shifts listed. (C.J.G.)

8937

GREEN'S FUNCTIONS IN THE THEORY OF MANY-FERMION SYSTEMS. M. Bolsterli (Univ. of Minnesota, Minneapolis). Phys. Rev. Letters 4, 82-4(1960) Jan. 15.

It is shown that the usual single-particle Green's function does not give direct information about the lowest excitation energies if there is a pairing energy (of the type familiar in nuclear physics). An alternate Green's function is suggested which will provide such information. (C.J.G.)

8938

NEW TEST FOR $\Delta I = \frac{1}{2}$ IN K^+ DECAY. Steven Weinberg (Univ. of California, Berkeley). Phys. Rev. Letters 4, 87-9(1960) Jan. 15.

A test of the $\Delta I = \frac{1}{2}$ rule, based on a comparison of the pion-energy distributions in τ^+ and $\tau^{+\prime}$ decay was devised and applied to K^+ decay. (C.J.G.)

8939

HIGH-ENERGY LIMIT OF SCATTERING CROSS SECTIONS. D. Amati, M. Fierz, and V. Glaser (European Council for Nuclear Research, Geneva). Phys. Rev. Letters 4, 89-91 (1960) Jan. 15.

Pomeranchuk has shown that the difference of the cross sections for a particle and its charge conjugate on the same target tends to vanish at infinity, i.e., $\sigma^+(\infty) = \sigma^-(\infty)$. Pomeranchuk points out that due to the finite range of interaction between particles, the quantity $A^2(E)/E$ (where $A^2(E)$ is the forward scattering amplitude for the corresponding process averaged over possible spins and E is the total energy of the incoming particle in the laboratory system on a specific target) should go to a limit with increasing E. It is shown that the unsubtracted dispersion relations for the difference of particle and antiparticle amplitudes converge to zero because of the vanishing of $\sigma^+ - \sigma^-$ at very high energies. (C.J.G.)

8940

THE EFFECT OF THE STRUCTURE OF THE NUCLEON ON THE CAPTURE OF μ^- MESON BY PROTON. H. Y. Tzu, T. H. Ho, and Y. B. Dai (Inst. of Atomic Energy Research and Inst. of Mathematics, Academia Sinica, Peking). Wu Li Hsüeh Pao 15, 521-4(1959) Oct. (In Chinese)

It is noted that, owing to the similarity existing between electromagnetic interaction and the vector part of the weak interaction proposed by Feynman and Gell-Mann, the contribution of the vector part of the weak interaction to μ^- capture by a proton is closely related to the electromagnetic form factors of the nucleon. Formula for the capture probability calculated with the renormalized V−A, weak interaction is given. The correction to the contribution of the vector part of the weak interaction due to the charge and magnetic moment distribution of the nucleon is estimated on the basis of the data from electron-nucleon scattering experiments. (auth)

Nuclear Properties and Reactions

8941 AD-200107

North Carolina State Coll., Raleigh.

AN INVESTIGATION OF THE DECAY SPECTRUM OF Mn^{56} (thesis). James William Daughtry. 1958. 42p.

A coincidence gray-wedge pulse-height analyzer was used to examine the decay spectrum of Mn^{56} by beta-gamma and gamma-gamma coincidence. The gamma disintegration spectrum was photographed and analyzed. The 2.56-Mev gamma ray was not detected. A very low intensity gamma ray was observed around 3.3 Mev. A decay scheme for Mn^{56} is presented which incorporates results obtained by previous authors. (C.J.G.)

8942 BLG-39

Brussels. Centre d'Étude de l'Énergie Nucléaire.

MESURES DE COINCIDENCES γ−γ AVEC UN CIRCUIT DE HOOGENBOOM ET APPLICATION AUX GAMMA DE CAPTURE DE NEUTRONS PAR Sm^{149} ET Hg^{199}. (Measurement of γ−γ Coincidences with a Hoogenboom Circuit and Application to Gamma Capture of Neutrons by Sm^{149} and Hg^{199}). J. Vervier. July 13, 1959. 64p.

A sum circuit following the design of Hoogenboom has been constructed to study gamma-gamma cascades. As suggested by Hoogenboom, a fast-coincidence circuit has been added. The apparatus has been tested by observing the annihilation gamma rays of β^+ in Na^{22} and known cascades in Co^{60}, Na^{22}, Cl^{38}, Mn^{56}, and In^{116}. It has been utilized to study the capture gamma rays of neutrons in Sm^{149} and Hg^{199}. (auth)

8943 CEA-1093

France. Commissariat à l'Énergie Atomique, Paris.

MESURE DE LA SECTION EFFICACE DE FISSION DE L'URANIUM-235 ENTRE 4EV ET 20 KEV. (Measurement of the Fission Cross Section of Uranium-235 between 4 ev and 20 kev). A. Michaudon, R. Genin, R. Joly, and G. Vendryes. Jan. 1959. 25p.

The neutron fission cross section of uranium-235 has been measured between 4 ev and 20 kev by the time of flight method with the Saclay electron linear accelerator as a pulsed neutron source. After a brief description of the experimental apparatus and the conditions of work during the experiment, the curve $\sigma_F \sqrt{E}$ in the energy range studied is shown. This curve is then analyzed by the "area" method and a set of $\sigma_0 \Gamma_F$ values is obtained. With $\sigma_0 \Gamma$ values measured in other laboratories, it is possible to compute fission widths for several resonances and to study their distribution. This distribution is then compared to Porter-Thomas distributions with different values of the number of exit channels. (auth)

8944 LA-490

Los Alamos Scientific Lab., N. Mex.

FURTHER INVESTIGATION OF SPONTANEOUS FISSION IN PLUTONIUM. G. W. Farwell, E. Segre, A. Spano, and C. E. Wiegand. Apr. 25, 1946. Decl. Dec. 18, 1959. 59p. OTS.

The spontaneous fission decay rates of Pu^{238} and Pu^{240} are 7.7×10^6 and 1.66×10^6 fissions per gram hour, respectively. Comparison of spontaneous fission analyses of

a number of samples of pile-produced plutonium with Hanford data on the plutonium concentration in the uranium from which they were extracted shows that, in pile material,

$$\frac{Pu^{240}}{Pu^{239}} = 71 \times \frac{Pu^{239}}{U^{238}}$$

The isotope Pu^{240} is almost entirely responsible for the spontaneous fission activity observed in pile-produced plutonium; other isotopes of plutonium and isotopes of elements 95 and 96 make no appreciable contribution. (auth)

8945 NP-8363

Westinghouse Electric Corp. Research Labs., Pittsburgh.
MULTIGROUP NEUTRON DATA FOR DEUTERIUM. Research Report 410FF323-R1. W. S. Emmerich. Sept. 15, 1958. 15p.

Computations are presented which were designed to provide input data on deuterium for use with multigroup computing codes. The quantities examined and tabulated are the elastic scattering cross section, the radiative capture cross section, the disintegration cross section, the Legendre polynomial coefficient for l = 1 of the angular distribution of scattered neutrons in the laboratory system, and the mean lethargy gain for elastic collisions. The values of the various input quantities are the lethargy (u = ln(10/E)) averages taken over a group interval. The cross sections were derived from experiments when possible with extrapolations based on knowledge of theoretical behavior. (C.J.G.)

8946 ORNL-2869

Oak Ridge National Lab., Tenn.
THERMAL AND RESONANCE ABSORPTION CROSS SECTIONS OF THE U^{233}, U^{235}, AND Pu^{239} FISSION PRODUCTS. E. A. Nephew. Mar. 1, 1960. 50p. Contract W-7405-eng-26. OTS.

The absorption cross section of the fission product aggregate of U^{233}, U^{235}, and Pu^{239} was calculated as a function of irradiation and the degree of flux thermalization. Attention was given to the resonance integral of the fission products in the range of 0 to 100 ev. The saturation characteristics of the individual fission products which determine the composition of the fission product aggregate are calculated for fluxes with different epithermal contents. The parameter P used to specify the degree of flux thermalization represents the fraction of fissions due to the neutrons in the 1/E portion of the flux. By summing over the individual fission products, a resulting thermal cross section and an energy distributed resonance integral were obtained for the fission product aggregate of the three fuels as a function of P and F where F is the fractional burnup of the fuel. For F = 0 and T = 1000°K, the effective thermal cross sections are calculated to be 37, 43, and 54 barns per fission for U^{233}, U^{235}, and Pu^{239}, respectively. At the same conditions, the excess resonance integrals below 100 ev are calculated to be 134, 172, and 266 barns per fission for U^{233}, U^{235}, and Pu^{239}, respectively. By grouping the individual fission products which have similar saturation characteristics, it was possible to designate four pseudoelements which when taken together yield the same total thermal cross section and resonance integral as that of the fission product aggregate over the range of P and F values considered. Multigroup cross sections were computed and are listed for each pseudoelement for use in a 32-group code. Thermal group cross sections are listed for each pseudoelement for neutron temperatures between 69 and 2704°F. (auth)

8947 TT-845

THE HALF-LIFE AND DECAY SCHEME OF U^{235}. (Lebensdauer und Zerfallsschema von U^{235}). E. Würger, K. P. Meyer, and P. Huber. Translated by D. A. Sinclair from Helv. Phys. Acta 30, Nos. 2-3, 157-82(1957). 34p. JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 9525.

8948

THE K–LL AUGER SPECTRUM OF Sm^{152}. G. T. Ewan, R. L. Graham, and L. Grodzins (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 38, 163-7(1960) Feb.

The K–LL Auger spectrum of Sm^{152} was studied in a high-resolution β-ray spectrometer with a proportional counter detector. Seven lines were observed in the Auger spectrum with the following energies: 31.20, 31.62, 32.01, 32.19, 32.25, 32.61, and 33.22 kev. The relative intensities were 1.0, 1.39, 0.26, 1.18, 0.29, 3.14, and 1.39, respectively. These measurements are compared with the theoretical predictions of Asaad and Burhop. The measured energies are ~50 to 60 ev higher than their predictions. Discrepancies exist in the relative intensities but these are smaller than were observed at Z = 94. (auth)

8949

THE GAMMA-NEUTRON CROSS SECTION FOR N^{14}. J. D. King, R. N. H. Haslam, and R. W. Parsons (Univ. of Saskatchewan, Saskatoon). Can. J. Phys. 38, 231-9(1960) Feb.

The reaction $N^{14}(\gamma,n)^{13}$ was studied by irradiating dicyandiamide in the x-ray beam of a 25-Mev betatron and measuring the residual activity with a sodium iodide crystal system. The photoneutron cross section shows maxima at 11.7, 13.2, 15.2, 19.5, and 22.8 Mev, the last two being in the giant resonance region. The integrated cross section from threshold to the beginning of the giant resonance region is 1.8 Mev-mb which was compared with a recent theoretical prediction. Measurements were made of the half life of N^{13} and it was found to be 9.93 ± 0.05 minutes. (auth)

8950

TRANSITION INTENSITIES AND CONVERSION COEFFICIENTS IN Dy^{160}. M. A. Clark (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 38, 262-71(1960) Feb.

The K-conversion coefficients for gamma transitions in Dy^{160} were measured and the transition multipolarities determined as follows (E_γ, α_K, multipolarity): 86.7 kev, 1.5 (E2); 197 kev, 1.6×10^{-1} (E2); 216 kev, 4.0×10^{-2} (E1); 299 kev, 1.3×10^{-2} (E1); 880 kev, 3.1×10^{-3} (E2); (962 + 966) kev, 2.5×10^{-3} (E2); 1179 kev, 6.6×10^{-4} (E1); 1205 kev, 4.6×10^{-4} (E1); 1273 kev, 6.1×10^{-4} (E1); and 1315 kev, 3.9×10^{-4} (E1). Relative transition intensities were compared with the predictions of the Unified Model of Bohr and Mottelson and the asymmetric rotor theory of Davydov and Filippov. Transition intensities from the 966-kev level to members of the ground state rotational band suggest the asymmetric rotor interpretation. (auth)

8951

ALPHA DECAY AND FISSION OF ALIGNED NUCLEI. N. R. Steenberg and R. C. Sharma (Univ. of Toronto). Can. J. Phys. 38, 290-314(1960) Feb.

The theory of the angular distribution of alpha particles and of fission fragments from nuclei aligned at low temperatures is presented. Very explicit results are obtained in the high temperature approximation. These are directly dependent upon the branching which takes place to the various allowed partial waves. This branching is influenced by the nuclear shape, but it is shown that for this problem the effect of penetrating a spheroidal barrier is not critical. An application is made to the experimental work of other authors and the theory is found to agree satisfactorily. (auth)

8952

A NOTE ON THE REACTION $Zn^{64}(\gamma,n)Zn^{63}$. J. P. Roalsvig, R. N. H. Haslam, and J. L. Bergsteinsson (Univ. of Saskatchewan, Saskatoon). Can. J. Phys. 38, 320-4(1960) Feb.

The activation curve for the reaction $Zn^{64}(\gamma,n)Zn^{63}$ was determined from threshold to 23 Mev. The absolute yield was 1.60×10^8 n/mole 100r at 22 Mev. Using the method of Penfold and Leiss, the maximum cross section was calculated to be 48 mb and 0.33 Mev-barn. These results were lower than the values obtained by other authors. (C.J.G.)

8953

RELATIVE INTENSITIES OF K–LL AUGER LINES IN Gd^{156}. G. T. Ewan and Janet S. Merritt (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 38, 324-7 (1960) Feb.

The K–LL Auger spectrum of Gd^{156} was observed in a study of the low-energy conversion line spectrum of Eu^{156}. Seven lines were observed with relative intensities of 1.0, 1.40, 0.27, 1.11, 0.19, 3.08, and 1.28 kev. The measured relative intensities were compared with results from Sm^{152} obtained by Ewan et al., and found to be in good agreement. A comparison of the measurements with theoretical predictions by Asaad and Burhop for Z = 64 revealed poor agreement. (C.J.G.)

8954

ANTISYMMETRIZATION OF "CLUSTER MODEL" WAVE FUNCTIONS AND THEIR EXPANSION IN "SHELL MODEL" WAVE FUNCTIONS. Th. Kanellopoulos and K. Wildermuth (European Council for Nuclear Research, Geneva). Nuclear Phys. 14, 349-75(1960) Jan. (1). (In English)

A method is described whereby oscillator "Cluster Model" wave functions may be antisymmetrized and expressed as a superposition of "Shell Model" wave functions. The antisymmetrization of wave functions in general is discussed. The Cluster Model calculations are useful when passing from the oscillator wave functions to more general cluster wave functions. (auth)

8955

APPLICATION OF THE COLLECTIVE MODEL TO SOME NUCLEI IN THE d-SHELL. G. R. Bishop (Ecole Normale Supérieure, Orsay, France). Nuclear Phys. 14, 376-88 (1960) Jan (1). (In English)

Eigenvalues and eigenfunctions were calculated for the Nilsson deformed potential well with the addition of a term μl^2. Comparison of the results with the decay schemes of nuclei in the d-shell revealed that some of the existing discrepancies are removed by the presence of this correction to the oscillator potential dependent on the orbital angular momentum. (auth)

8956

COLLECTIVE ROTATIONS OF NUCLEI. Eugene P. Gross (Brandeis Univ., Waltham, Mass.). Nuclear Phys. 14, 389-97(1960) Jan. (1). (In English)

An analysis is made of descriptions of collective motions of nuclei which involve the application of projection operators to a localized nuclear wave function ψ. This procedure leads to an incorrect description of center of mass motion. The proposed solution is to consider functions of the form $\psi e^{iS/\hbar}$, and to vary the functional form of the velocity potential S, subject to the constraint that the expectation value of the constant of motion has a given value for the state of collective motion. For translational motion this localized function leads to the correct effective mass. The subsequent application of a projection operator mainly improves the zero momentum wave function. For rotational motion the velocity potential is expressed in terms of the excited states of a potential defined by ψ. The resulting moment of inertia is that of Inglis. The knowledge of the correct velocity potential for a given ψ suggests approximate trial functions S which express the moments of inertia solely in terms of properties of the ground state ψ. (auth)

8957

ENHANCEMENT OF E2 TRANSITION PROBABILITY. Dieter Kurath (Argonne National Lab., Lemont, Ill.). Nuclear Phys. 14, 398-406(1960) Jan. (1). (In English)

The method of generator coordinates is applied to the calculation of E2 transition probabilities. Complete single-particle states in a deformed well are used as generator functions, and the transition from the first excited state to the ground state of C^{12} is computed as an example. The degree of enhancement is found to be of a magnitude consistent with experiment. The effect of center-of-mass motion and other factors affecting the validity of the result are discussed. (auth)

8958

ROLE OF SPIN-ORBIT FORCE IN NUCLEAR INTERACTIONS. A. N. Mitra and V. L. Narasimham (Muslin Univ., Aligarh, India). Nuclear Phys. 14, 407-28(1960) Jan. (1). (In English)

The two-body problem (scattering and bound state) was solved exactly by considering an extension of Yamaguchi's non-local separable potential to include a two-body spin-orbit force. The parameters of the potential were determined by obtaining their exact relationships with the low-energy experimental data (scattering length, effective range, deuteron binding energy, quadrupole and magnetic moments, and the D-state probability). It is found that to fit the data, particularly the magnetic moment, the strength of the spin-orbit force must be comparable to that of the tensor force. This potential was applied to the evaluation of the spin-orbit energy splitting in the nuclei Ca^{41} and O^{17}. It is found that the tensor force by itself gives the wrong sign of the splitting and that it is overcompensated by a large contribution (of the correct sign) arising from the two-body spin-orbit force. (auth)

8959

DECAY OF Gd^{146} AND Eu^{146}. N. M. Antonieva, A. A. Bashilov, B. S. Dzhelepov, and V. A. Sergienko (Leningrad Univ.). Nuclear Phys. 14, 438-42(1960) Jan. (1). (In English)

The spectra of conversion electrons of neutrino-deficient isotopes Gd^{146} and Eu^{146} are investigated. For Gd^{146}, three nuclear transitions with energies of 114.8, 115.5, and 155 kev were observed and the coincidences among their conversion electrons were studied. For Eu^{146}, transitions with energies of 630 and 742 kev were observed. Mechanisms of disintegration are suggested. (auth)

8960

ON DECAY OF Se^{75}. E. P. Grigoriev and A. V. Zolotavin (Leningrad Univ.). Nuclear Phys. 14, 443-58(1960) Jan. (1). (In English)

The conversion and γ-ray spectrum of Se^{75} was investigated with a $\pi\sqrt{2}$ double focusing spectrometer possessing a line half width of 0.4%. The relative conversion and γ line intensities, conversion coefficients, and transition multipolarities were determined. (auth)

8961

INVESTIGATIONS OF THE DECAY-SCHEME OF Fe^{59}. D. Berényi, Gy. Máthé, and T. Scharbert (Inst. of Nuclear

Research, Hungarian Academy of Sciences, Debrecen). Nuclear Phys. 14, 459-64(1960) Jan. (1). (In English)

The gamma-ray spectrum and gamma-gamma coincidence spectrum of Fe^{59} was examined by means of scintillation spectrometers. The two lines of high energy were found to be 1.08 and 1.27 Mev, respectively. Between these lines no genuine coincidence could be detected. The analysis of beta spectrum and beta-gamma coincidence spectra yielded the beta groups of 275 ± 5 and 455 ± 5 kev endpoint energies. The intensity of these groups was 44.6 and 55.4% respectively, and their corresponding log ft values were 5.3 and 6.1. The relative intensity of the high energy beta transition directly into the ground state was found not to attain 0.5%. (auth)

8962

PROPERTIES OF LEVELS EXCITED IN (p,α) REACTIONS ON O^{18}, P^{31}, Cl^{35}, Cl^{37}, K^{39} AND K^{41}. R. L. Clarke, E. Almqvist, and E. B. Paul (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nuclear Phys. 14, 472-97(1960) Jan. (1). (In English)

Excitation functions and differential cross sections at 90° to the beam were measured for the (p,α) ground state reactions in O^{18}, P^{31}, Cl^{35}, Cl^{37}, K^{39}, and K^{41} from 1 to 3 Mev proton energy using a magnetic spectrometer to detect the alpha particles. Reduced widths and strength functions for protons and alpha particles are derived; the alpha-particle strength functions are a factor of five smaller than the proton values which agree with published results of (p,n) studies in the mass 40 region. The reduced widths of protons and alpha particles in units of $\hbar^2/\mu R^2$ are both 3×10^{-2} for P^{31} and decrease to 0.4×10^{-2} near mass 40. The equality of the proton and alpha-particle reduced widths suggests that these particles appear on the nuclear surface with equal probability. The measured mean level spacing runs from 78 kev for P^{31} to <15 kev in the mass 40 region. These are larger than is predicted by the semi-empirical level spacing equation of Cameron. The measured Q-values of the (p,α) reaction were determined for the isotopes: Cl^{35} = 1.865 ± 0.015 Mev, Cl^{37} = 3.015 ± 0.015 Mev, K^{39} = 1.267 ± 0.020 Mev, and K^{41} = 4.002 ± 0.020 Mev. (auth)

8963

AN APPROXIMATION FOR NUCLEON-NUCLEUS POLARIZATION EFFECTS. Kenneth R. Greider (Univ. of California, Berkeley). Nuclear Phys. 14, 498-505(1960) Jan. (1). (In English)

A simple, approximate method of incorporating the effects of a nuclear spin-orbit potential in the wave function was developed. When used with the appropriate optical-model wave function for the central potential, it permits closed-form solutions for polarizations and cross sections that are about as simple to obtain as the Born-approximation solutions. Its application is discussed in two types of problems: the elastic scattering of nucleons by nuclei, and the "direct" interaction type of nuclear rearrangement collision. In this latter problem it is found that the elastic scattering of initial and final state particles from the nuclear spin-orbit potential is primarily responsible for the observed polarization effects. (auth)

8964

MECHANISM OF INTERACTION OF FAST PROTONS WITH NUCLEONS AND NUCLEI. V. S. Barashenkov, V. A. Beliakov, V. V. Glagolev, N. Dalkhazhav, Yao Tsyng Se, L. F. Kirillova, R. M. Lebedev, V. M. Maltsev, P. K. Markov, M G. Shafranova, K. D. Tolstov, E. N. Tsyganov, and Wang Shou Feng (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 14, 522-39(1960) Jan. (1). (In English)

Angular and energy characteristics of interaction between 9 Bev protons and emulsion nuclei, as well as the production of strange particles were investigated. The experimental results reveal a better agreement with the cascade mechanism of nucleon-nucleus interaction than with the nucleon-tube model. The average energy loss in a single nucleon-nucleon collision was estimated to be (40 ± 10)%. The size of a nucleon core is discussed. Through the optical analysis of nucleon-nucleon interactions the value $r_c \approx 0.6 \times 10^{-13}$ cm was obtained for the size of the nucleon core, while the fraction of peripheral collisions constitutes ≈20%. Angular and energy distributions of slow K^+ and $\pi^\pm$ mesons were obtained. The production cross-section for K^+ mesons with energy up to 140 Mev on an average emulsion nucleus is $\sigma = 5 \pm 2$ mb. (auth)

8965

ON EXCITATION OF NUCLEI BY μ-MESONS. D. F. Zaretskii (Zaretsky) and V. M. Novikov (Atomic Energy Inst., Academy of Sciences, USSR). Nuclear Phys. 14, 540-4(1960) Jan. (1). (In English)

Excitation of heavy nuclei in μ-mesic atom 2p−1s transitions is considered. The effect is connected with the electromagnetic interaction between the meson and nucleus. The ratio of the probability of emission of a γ-quantum during the indicated transition to the probability of transfer of all the transition energy to the nucleus with subsequent dissipation of the energy through nuclear channels is computed. The case is considered when the distance between the nuclear levels is much greater than the width of the levels for the indicated excitation energy. (auth)

8966

CONTRIBUTION TO THE STUDY OF ANTIPROTON ANNIHILATION IN COMPLEX NUCLEI. A. Berthelot, C. Choquet, A. Daudin, O. Goussu, and F. Lévy (Centre d'Études Nucléaires, Saclay, France). Nuclear Phys. 14, 545-64(1960) Jan. (1). (In French)

207 stars resulting from p annihilation were analyzed. Results are given concerning the mean free path for annihilation as well as the main characteristics of annihilation stars. The proportion of stars which are effectively accompanied by at least one visible K meson is (4.6 ± 0.5) %. The error quoted does not take into account the statistical uncertainty. The average numbers are compared to the Berkeley results. (auth)

8967

THE DISINTEGRATION OF La^{131}. Charles B. Creager, C. W. Kocher, and Allan C. G. Mitchell (Indiana Univ., Bloomington). Nuclear Phys. 14, 578-88(1960) Jan. (2). (In English)

The decay of La^{131} was studied with the help of a magnetic lens spectrometer, scintillation spectrometers and scintillation coincidence spectrometers. The half life is 61 ± 2 min. Three positon groups were found having endpoint energies and relative abundances as follows: 1.939 ± 0.045 Mev (27%), 1.424 ± 0.036 Mev (56%), 0.704 ± 0.045 Mev (17%). Gamma rays are found at 115, 169, 214, 254, 285, 364, 417, 445, 511 (annihilation radiation), 597, and 878 kev. The line at 115 kev is strongly internally converted. A disintegration scheme is proposed. (auth)

8968

LEVELS IN ^{200}Hg POPULATED FROM THE DECAY OF ^{200}Au. R. K. Girgis, R. A. Ricci, and R. Van Lieshout

(Instituut voor Kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 14, 589-96(1960) Jan. (2). (In English)

The decay of 48 minute Au^{200} was investigated. Only three gamma rays (370, 1225, and 1600 kev) were found to follow the decay of this isotope. Excited states at 370 and 1595 kev in Hg^{200} can accommodate these gamma rays. No gamma rays were found to correspond to the excitation or the deexcitation of a level at 950 kev, which was observed in both the neutron capture gamma ray work on Hg^{199} and in the beta decay investigations of Tl^{200}. Evidence is presented for a new gold activity with a half life of 19 ± 2 hours. (auth)

8969

LEVELS IN ^{200}Hg STUDIED FROM THE DECAY OF ^{200}Tl. R. K. Gupta, R. K. Girgis, and R. Van Lieshout (Instituut voor kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 14, 597-605(1960) Jan. (2). (In English)

The gamma-ray spectrum from the decay of Tl^{200} was investigated with a scintillation spectrometer. The ground state transitions from the 1595, 1732, and 1885 kev levels in Hg^{200} were detected. From summing studies and from the direct gamma-ray spectrum the existence of new levels at 2000 ± 20, 2280 ± 20, and 2400 ± 30 kev in Hg^{200}, populated from the decay of Tl^{200}, is inferred. (auth)

8670

ON THE DECAY OF ^{123}I. R. K. Gupta (Instituut voor kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 14, 606-14(1960) Jan. (2). (In English)

The gamma rays from the decay of I^{123}, produced by alpha bombardment of enriched Sb^{121}, were investigated with a scintillation spectrometer. New gamma rays of 275 ± 10, 320 ± 10, 340 ± 10, 380 ± 10, 435 ± 10, 500 ± 10, and 530 ± 10 kev emitted in the decay of I^{123} were detected. From summing studies and from the direct gamma ray spectrum the existence of levels at 435 and 502 kev in Te^{123}, known from Coulomb excitation, was confirmed. In addition, the existence of new levels at 690 ± 10 and 320 ± 10 kev in Te^{123} is inferred. New gamma rays of 275 ± 10 and 320 ± 10 kev belonging to the decay of I^{121} were detected. (auth)

8971

A SEARCH FOR PARITY MIXTURES IN NUCLEAR STATES. F. Boehm and U. Hauser (Universität, Heidelberg, Ger.). Nuclear Phys. 14, 615-25(1960) Jan. (2). (In English)

The gamma radiation emitted from nuclear states which are polarized by beta decay can show a 90 degree asymmetry if parity conservation in nuclear states does not hold strictly. A beta-gamma angular-correlation experiment yields linearly the quantity RF, where F is the relative amplitude of the irregular wave function with respect to the regular one and R is the matrix-element ratio of the gamma transitions. The measurements are performed with the beta-gamma decays of $Ar^{41} \rightarrow K^{41}$, $Xe^{133} \rightarrow Cs^{133}$, and $Lu^{177} \rightarrow Hf^{177}$ and result in the following upper limits for F: 6×10^{-5} for Ar^{41}, 2×10^{-4} to 8×10^{-4} for Xe^{133}, and 3×10^{-3} for Lu^{177}. (auth)

8972

K-MESON PRODUCTION IN π-p COLLISIONS AND K-MESON PARITY. V. Gupta (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 14, 626-32(1960) Jan. (2). (In English)

The reactions $\pi^- + p \rightarrow p + K^+ + \bar{K}^0$ and $\pi^- + p \rightarrow K^- + K^0$ are considered and numerical values of the differential cross-sections given. The calculations were done with a two-fold purpose: (i) on the Gell-Mann coupling scheme, with the hope of deciding between the two cases of even and odd relative K-N parity and (ii) on the recent suggestion of a KK π-interaction by Pais (requiring odd $K^+ - K^0$ relative parity) with a view to test its existence. (auth)

8973

THE ANGULAR DISTRIBUTION OF β PARTICLES. G. Rakavy (Hebrew Univ., Jerusalem). Nuclear Phys. 14, 661-81(1960) Jan. (2). (In English)

A general formula is given for the angular distribution and polarization of electrons emitted in β decay from oriented nuclei. The formula is convenient for actual calculations on the one hand, and transparent enough to see in a straightforward way the influence of the various interaction types on the other hand. The result is also in a form convenient for switching it into the general formalism of angular correlations so as to get $\beta-\gamma$ correlations (with or without polarization observation). (auth)

8974

ON THE CONSERVED POLAR VECTOR CURRENT IN BETA-DECAY. R. J. Blin-Stoyle, V. Gupta, and J. S. Thomson (Clarendon Lab., Oxford). Nuclear Phys. 14, 685-92(1960) Jan. (2). (In English)

It is suggested that if the polar vector current in beta-decay is not conserved, mesonic exchange effects may be appreciable in $0^+ \rightarrow 0^+$ transitions. Experimental data indicate that such effects are not present to more than 5% in $O^{14} \rightarrow N^{14}$. (auth)

8975

FLUCTUATIONS OF PARTIAL RADIATION WIDTHS OF U^{239}, Hf^{178}, AND Pt^{196}. J. E. Draper and C. O. Bostrom (Yale Univ., New Haven). Nuclear Phys. 14, 693-5(1960) Jan. (2). (In English)

Partial radiation widths in U^{239}, Hf^{178}, and Pt^{196} are shown to have significant fluctuations which are not always as large as those of the reduced neutron widths. One finds J = 1 for the 11.9- and 19.6-ev resonances of Pt. (auth)

8976

THE ABSORPTION CROSS SECTION OF COPPER FOR THERMAL NEUTRONS. D. J. Donahue, R. A. Bennett, and D. D. Lanning (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 7, 184-6(1960) Feb.

The rate of neutron absorption in several gold and copper samples was measured in the PCTR for two different configurations of the fuel and moderator. From these rates, and the corresponding cadmium ratios, the ratio of copper to gold absorption rates for thermal neutrons, and therefore the ratio of the thermal-neutron absorption cross section of copper to that of gold, was determined. For a value of σ_{Au} (0.0253 ev) = 98.8 ± 0.3 barns, the result σ_{Cu} (0.0253 ev) = 3.79 ± 0.04 barns is obtained. (auth)

8977

TOTAL NEUTRON CROSS SECTIONS OF U^{233} AND U^{235} FROM 0.02 TO 0.08 ev. O. D. Simpson, M. S. Moore, and F. B. Simpson (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 7, 187-92(1960) Feb.

Neutron transmission measurements of U^{233} and U^{235} were obtained from 0.02 to 0.08 ev. The 2200 m/sec total neutron cross section values were calculated from a linear least-squares fit to the data in this region and found to be 587 ± 6 and 690 ± 10 barns, respectively. The data were taken with the Materials Testing Reactor (MTR) fast chopper with an instrument resolution of 2 μsec/m. Experimental techniques, involving the use of a 1024-channel time-of-flight analyzer for measuring total cross sections at low energies, are described. (auth)

8978

TOTAL CROSS SECTIONS OF Ti, V, Y, Ta, AND W. R. E.

Schmunk, P. D. Randolph, and R. M. Brugger (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 7, 193-7(1960) Feb.

Total neutron cross sections were measured by the transmission method for metal samples of Ti, V, Y, Ta, and W in the energy range from 0.002 to 0.285 ev. The data are in agreement, within experimental error, with the previously published data at energies for which a comparison can be made. Absorption cross sections for 0.0253-ev neutrons, obtained by fitting a 1/v line to the total cross section at cold neutron energies, give 20 ± 0.9 and 18.8 ± 0.8 barns for Ta and W, respectively. (auth)

8979

LEE MODEL WITH COMPLEX ENERGY EIGENVALUES. R. Ascoli (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin) and E. Minardi (Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 14, 1254-65(1959) Dec. 16. (In English)

The Lee model with fixed point particles is investigated when complex energy eigenvalues appear in the subspace $(V, N + \theta)$. It is proved that in general such a model has no physical interpretation, at least in the usual framework. Indeed a problem in the subspace $(2V + \theta, V + N + 2\theta, 2N + 3\theta)$ is considered, and it is shown that expressions which are usually interpreted as probabilities become negative. Such difficulties do not appear in simpler problems. (auth)

8980

REACTIONS OF Cu^{63} AND Cu^{65} WITH ALPHA PARTICLES. Norbert T. Porile and David L. Morrison (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 1193-1200 (1959) Dec. 1.

Excitation functions were measured for the (α,n), $(\alpha,2n)$, and $(\alpha,\alpha n)$ reactions on Cu^{63} and Cu^{65}, as well as for the $Cu^{63}(\alpha,pn)$, $Cu^{65}(\alpha,2p)$, and $Cu^{65}(\alpha,2\alpha)$ reactions, for incident alpha particles of 15 to 41 Mev. The excitation functions for the (α,n), $(\alpha,2n)$, and (α,pn) reactions go through much sharper maxima than the excitation functions for the $(\alpha,\alpha n)$ reactions. Cross sections for the $(\alpha,2p)$ and $(\alpha,2\alpha)$ reactions increase monotomically with bombarding energy and attain values of 2.7 and 2.1 mb at 40 Mev, respectively. The value of $\sigma(\alpha,pn)/\sigma(\alpha,2n)$ for Cu^{63} in the region of maximum yield is 3.3. The maximum cross sections measured for the $(\alpha,\alpha n)$ reactions are 205 and 143 mb for Cu^{63} and Cu^{65}, respectively. The effects on the observed cross sections of neutron and proton binding energy differences, and of level density differences in the residual nuclei were considered. The effect of these factors is in accord with the predictions of the statistical theory for the (α,n) and $(\alpha,2n)$ reactions but not for the $(\alpha,\alpha n)$ reaction. A method for monitoring the energy of the incident beam based on the variation with energy of the ratio of cross sections for several of the above reactions is described. (auth)

8981

THREE-BODY BREAKUP; DEUTERON DISSOCIATION CROSS SECTIONS. James E. Young (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 116, 1201-11(1959) Dec. 1.

An analysis of the reaction X(d,np) was carried out within the framework of the algebraic theory of scattering. It is possible to cast the transition matrix element governing the process into several forms. In particular, one of these, the asymmetric form, involves no nuclear interactions for one of the deuteron constituents. The other forms, so-called symmetric, contain interactions for all particle pairs and are shown to be inherently superior to the asymmetric expression. Calculations of the neutron spectrum, at zero degrees in center of mass, for 6.3-Mev deuterons on deuterons are presented. These are done in an S-wave approximation to illuminate the theoretical discussions; and a comparison is made with experimental data. It is concluded that the theory as presented is capable of describing the dissociation reaction. The description involves only those interactions to which we have ready access through experiment. (auth)

8982

CONSERVATION OF PARITY IN STRONG INTERACTIONS. R. Haas, L. B. Leipuner, and R. K. Adair (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 1221-5(1959) Dec. 1.

An investigation was made of the angular distribution of the gamma rays produced by the capture of slow polarized neutrons in cadmium, indium, and silver. The portion of the intensity of the transitions from the spin-one capture state of Cd^{114} to the spin-zero ground state and spin-two first excited state, which is proportional to $\cos\theta$, where θ is the angle between the neutron spin and the direction of propagation of the gamma ray, was measured to be less than one part in 10^3. From this result the conclusion is reached that the intensity of the odd-parity part of the neutron capture state is less than 2×10^{-3} times as large as the even-parity part, and that the parity-nonconserving part of nuclear forces is less than 10^{-3} times as strong as the parity-conserving part. Qualitatively similar, though weaker, conclusions were derived from the measurements on silver and indium. (auth)

8983

EXCITATION FUNCTION FOR THE $Al^{27}(d,\alpha p)Na^{24}$ REACTION BETWEEN 0 AND 28.1 Mev. P. A. Lenk and R. J. Slobodrian (Comisión Nacional de Energía Atómica, Beunos Aires). Phys. Rev. 116, 1229-31(1959) Dec. 1.

The excitation function for the $Al^{27}(d,\alpha p)Na^{24}$ reaction was measured between 0 and 28.1 Mev. The external beam facilities of the Buenos Aires 71-in. synchrocyclotron were used together with the stacked-foil technique. Between 19 and 28.1 Mev present results are more precise than those previously obtained, showing that the maximum of the cross section is located at 24.25 Mev with a value of 51.4 mb. (auth)

8984

NUCLEAR RELAXATION VIA QUADRUPOLE COUPLING. Robert L. Mieher (Univ. of Illinois, Urbana). Phys. Rev. Letters 4, 57-9(1960) Jan. 15.

Expressions are derived showing the temperature dependence of the quadrupolar nuclear spin–lattice relaxation time and the angular dependence of the nuclear spin–lattice relaxation time as the orientation of the crystal is varied with respect to the magnetic field. The nuclear spin relaxation time is expressed in terms of the predicted transition probabilities. Spin relaxation time measurements on In^{115} in InSb single crystals at 77°K gave an isotropic relaxation time of 0.80 ± 0.05 sec. Temperature dependence measurements of I^{127} in KI at 77 to 800°K are reported. A discussion of theoretical and experimental results is given. (C.J.G.)

8985

NUCLEAR RESONANCE ABSORPTION AND NUCLEAR ZEEMAN EFFECT IN Fe^{57}. G. DePasquali, H. Frauenfelder, S. Margulies, and R. N. Peacock (Univ. of Illinois, Urbana). Phys. Rev. Letters 4, 71-3(1960) Jan. 15.

Nuclear resonance absorption in Fe^{57} was measured at an angle $\theta = 30°$ as a function of temperature. Zeeman splitting was observed in the resonance absorption curve not corrected for absorber thickness or finite velocity

resolution and is considered due to the interaction of the magnetic moment μ^* of the excited state with the magnetic field H at the nucleus. The magnetic moment of the excited state was estimated to be $\mu^* = 0.50\mu_n$. The measured width of the central line, $2\Gamma = 3.4 \times 10^{-6}$ ev, was larger than the predicted value. (C.J.G.)

8986

POLARIZATION OF NUCLEAR RESONANCE RADIATION IN FERROMAGNETIC Fe^{57}. G. J. Perlow, S. S. Hanna, M. Hamermesh, C. Littlejohn, D. H. Vincent, R. S. Preston, and J. Heberle (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 4, 74-5(1960) Jan. 15.

The polarization of resonance radiation in Fe^{57} was observed with a ferromagnetic source and absorber magnetized parallel or perpendicular to each other. The transmission of the resonance radiation was measured through the absorbing foil as a function of the relative orientation of the fields in the source and the absorber. The transmission obtained with a vibrating source and that obtained with zero field in source and absorber indicate that the transmission is strongly dependent on the angle between the magnetizations of source and absorber. The alignment of the ferromagnetic domains in the source produces a corresponding alignment of the internal fields at the iron nuclei. The radiation emitted in the transition from one magnetic sublevel to another is linearly polarized when viewed perpendicular to the field; therefore, the magnetization of the source serves as a polarizer of radiation. (C.J.G.)

8987

NEW "BREAK" IN THE $O^{16}(\gamma,n)O^{15}$ REACTION WITH A NEW SYSTEM OF MEASUREMENT. D. Sadeh (Centre National de la Recherche Scientifique, Ivry, France). Phys. Rev. Letters 4, 75-6(1960) Jan. 15.

Using a 31-Mev betatron, cylinders of boric acid ($H_2B_2O_7$) were bombarded and the 2-min β^+ activity of the O^{15} was measured with a coincidence and single-channel analyzer system. Using this method, an excitation level was found at 15.76 ± 0.020 Mev for the $O^{16}(\gamma,n)O^{15}$ reaction. (C.J.G.)

8988

UNITARITY CONDITION BELOW PHYSICAL THRESHOLDS IN THE NORMAL AND ANOMALOUS CASES. S. Mandelstam (Univ. of California, Berkeley). Phys. Rev. Letters 4, 84-7(1960) Jan. 15.

It is shown that the use of the unitarity condition below the physical threshold ($4\mu^2 < t < 4M^2$) is applicable to both the normal and anomalous cases. Calculation of the imaginary part of the transition amplitude in the anomalous case for the entire region in which it fails to vanish is demonstrated with the unitarity condition. The validity of dispersion relations for partial waves throughout is assumed and the unitarity condition in the physical region is approximated by taking only two-particle intermediate states. (C.J.G.)

8989

NUCLEAR REACTION CROSS-SECTION THEORY. R. G. Moore, Jr. (Convair, Fort Worth, Tex.). Revs. Modern Phys. 32, 101-16(1960) Jan.

A summary of compound nucleus processes is given and a method, based on the compound nucleus model, is given for estimating the magnitude and energy dependence of nuclear cross sections. Expressions for the logarithmic derivative were derived, based on the two nuclear potentials: a strong interaction model (real square-well potential) and a square-well complex potential. Logarithmic derivatives of the optical-model potential were obtained by numerical integration of the radial wave equation into which was inserted the assumed potential form with suitable parameters. Methods for evaluating σ_c by first determining the transmission coefficients are discussed. The branching ratio of compound nucleus decay is considered for cases in which the statistical model for nuclear reactions is applicable. The probability of particle emission and the de-excitation by gamma emission in the compound nucleus are discussed. The branching ratio for gamma emission is shown to be given by the ratio of radiation width to total width. The radiative-capture cross section in the resonance region is obtained by multiplying the branching ratio by the resonance compound-nucleus cross section. (C.J.G.)

8990

RECENT EXPERIMENTAL RESULTS ON ORBITAL ELECTRON CAPTURE. Berol L. Robinson (Western Reserve Univ., Cleveland) and Richard W. Fink (Univ. of Arkansas, Fayetteville). Revs. Modern Phys. 32, 117-28(1960) Jan.

A summary is presented of experimental techniques and experimental results on electron-capture ratios, comparative half-lives, and transition energies. The effect of electron capture from the M shell and higher shells is taken into account. Transition energies are computed from the observed capture ratios for about twenty cases. A summary of mean L-fluorescence yields following nuclear excitation is given, and the origins of uncertainties in the interpretation of experimental results are discussed. Results from six experiments are compared with the theory of Brysk and Rose, and the observed L/K capture ratios are found to be ten percent greater than predicted. The discrepancies seem to be more or less independent of atomic number for $18 \leq Z \leq 53$. It is not clear that the effect of correlations between the coordinates of the K electrons, suggested by Odiot and Daudel, is sufficient to account for the discrepancy. (auth)

8991

ESTIMATION OF THE NUCLEAR MOMENT OF INERTIA AND THE g_R FACTOR. Chin-yuen Tseng, Ching-ying Chang, and Li-ming Yang (Peking Univ.). Wu Li Hsüeh Pao 15, 565-74(1959) Oct. (In Chinese)

An estimation of the nuclear moment of inertia and the collective g_R factor based on the cranking model of Inglis and Nilsson's wave function is made. The agreement with experimental value is satisfying not only in regard to magnitude but also in the tendency of variation with A and with the excited internal configurations. The agreement is considered due to the proper choice of an axial-symmetric self-consistent field including a strong spin-orbit coupling. (auth)

Particle Accelerators

8992 AD-209151

Montana State Univ., Missoula. Electron Linear Accelerator Lab.

MONTANA STATE UNIVERSITY ANNUAL SUMMARY REPORT [FOR] JANUARY 1, 1958 TO JANUARY 1, 1959. 8p. Contract Nonr-1662(00).

Using calibrated cover glasses as detectors, the penetration of monoenergetic electrons in glass was measured at 2.0, 3.5, 5.0, and 6.5 Mev. Penetration measurements were also made with 5.0-Mev electrons in carbon, aluminum, and tantalum. Data are presented graphically, and a diagram of the accelerator layout is included. (J.R.D.)

8993 AFCRC-TN-58-459

Harvard Univ., Cambridge, Mass. Harvard Coll. Observatory.

UTILIZATION OF THE ORBITAL RADIATION FROM THE CAMBRIDGE ELECTRON ACCELERATOR. ANGULAR DISTRIBUTION AND BEAM GEOMETRY. Scientific Report No. 6. D. H. Tomboulian and D. E. Bedo. July 15, 1958. 14p. Contract AF19(122)-482. (AD-152642).

Studies of the orbital radiation were carried out in order to determine the average power spectrum and to examine prospective experimental investigations based on the use of the radiation. Those aspects which are related to the angular distribution of the radiation and thus affect the geometrical spread of the radiation beam are discussed. (W.L.H.)

8994 MURA-539

Midwestern Universities Research Assn., Madison, Wis. CURRENT SOURCES FOR SCALING MAGNETIC FIELDS. [PART] II. S. C. Snowdon. Dec. 28, 1959. 12p. Contract AT(11-1)-384. OTS.

In spiral sector FFAG guide fields it has been customary to locate the potential grading pole face windings in azimuthal slots. It is shown that, for the limit in which the potential grading slots are considered to form a continuum, a scaling magnetic field is obtained if these slots are located along any smooth family of curves crossing between the feeder and return spiral slots. Specifically, the curves are considered to be members of the logarithmic spiral family. For generality, the results are extended to the case in which the pole face windings only partially fill the associated slots. (auth)

8995 NYO-2810

Pennsylvania. Univ., Philadelphia. A SCHEME FOR PARTICLE SEPARATION IN HIGH ENERGY BEAMS. H. M. Brody. Feb. 19, 1960. 6p. Contract AT(30-1)-2171. OTS.

A high-energy particle separator is proposed for separation of particles at momenta up to the highest produced by the Brookhaven AGS. (W.L.H.)

8996 UCRL-9094

California. Univ., Berkeley. Lawrence Radiation Lab. SOME PROBLEMS IN PLANNING FOR FUTURE HIGH ENERGY PROTON ACCELERATORS. David L. Judd. Jan. 29, 1960. 17p. Contract W-7405-eng-48. OTS.

Factors affecting the desirability and utility of ultra-high laboratory energies are discussed. Desirable properties of high-energy accelerators are discussed. (C.J.G.)

8997

CASCADE ACCELERATOR. Detlef Kamke (Universität, Marburg, Ger.). Kerntechnik 2, 15-19(1960) Jan. (In German)

A description begun in Kerntechnik 6, p.169(1959) is continued. The ion source and accelerator tube are described. The ion source is of the Thonneman type in which a plasma is produced by a high-frequency gas discharge. The ions are extracted from the plasma by a probe. The accelerator tube is a 20-cm ID glass or porcelain tube. The optics and physical structure are described. (T.R.H.)

8998

NEUTRON PROJECT, HARWELL. Nuclear Energy 14, 14-19(1960) Jan.

A description is given of the high-intensity pulsed neutron source at Harwell. The travelling wave linear accelerator, cooled by mercury, produces bursts of electrons with an energy of 30 Mev and at a rate of 750 pulses per sec. Four klystron amplifiers are utilized to produce the output of a peak RF power of 24 Mw. (C.J.G.)

8999

ELECTRON-OPTICAL CONSTRUCTION OF AN INHOMOGENEOUS ACCELERATING TUBE. E. Koltay (L. Kossuth Universität, Debrecen, Hungary). Nuclear Instr. and Methods 6, 45-9(1959) Dec. (In German)

The numerical application of the poligon method of Gans proved to be a simple and reliable procedure for the design of an accelerating tube with an inhomogeneous field for use in high voltage generators. Calculations were made using this method in connection with an accelerating tube of a Van de Graaff generator of 2 Mv. For the axial potential the data given by Kirkpatrick and Beckerley was used. (auth)

9000

INTERNAL TARGET FOR A BETATRON. H. Morinaga and T. Kuroyanagi (Tohoku Univ., Sendai). Nuclear Instr. and Methods 6, 66-71(1959) Dec. (In English)

An internal bombarding technique which was used to produce high specific activity on small samples in a 25-Mev betatron is described. The samples were bombarded behind the bremsstrahlung target where the x-ray density is extremely high. The design and operational characteristics and some examples of its application are presented. More than 1 mc of Cu^{62} was produced with a specific activity 500 times of that produced by an external bombardment. (auth)

9001

BOLTZMANN EQUATION FOR AN ELECTRON GUIDE FIELD ACCELERATOR. I. QUASI-STATIONARY SOLUTIONS FOR AN ELECTRON BEAM. Joachim B. Ehrman (U. S. Naval Research Lab., Washington, D. C.). Phys. Fluids 3, 121-8(1960) Jan.-Feb.

A simplified model for dePackh's version of an electron guide field accelerator is set up by substituting for the actual external quadrupole or solenoidal focusing magnetic field an azimuthally symmetric focusing field, and by replacing the actual toroidal geometry by a cylindrical geometry with periodic boundary conditions. The Boltzmann equation for an electron beam in this system is studied, and a set of solutions is obtained which contain just enough parameters to represent the quasi-stationary behavior of the beam realistically. The values of these parameters are related to the initial conditions of the beam by the adiabatic invariance of linear charge density and of the radial and azimuthal action integrals in the absence of collisions and radiation. Thus, the quasi-stationary development of the beam in time is determined without an explicit time dependence in the Boltzmann equation. While the electron energy is being increased by a betatron field, the beam passes from a condition in which its electrons are in almost neutral equilibrium with respect to displacement from the axis (low temperature or "$\frac{3}{2}$" regime) to a condition in which each electron is hardly affected by the other electrons (high temperature or betatron or "$\frac{1}{2}$" regime), as predicted by dePackh. If the beam is initially isothermal, the temperature becomes a monotonic decreasing function of distance from the axis in the course of electron energy increase. (auth)

9002

ON THE THEORY OF CIRCULAR PHASOTRON WITH RADIAL SECTORS. V. I. Kotov, Yu. L. Obukhov, and V. A. Pushtarik (Joint Inst. of Nuclear Research, Dubna, USSR). Pribory i Tekh. Ekspt. No. 5, 19-22(1959) Sept.-Oct. (In Russian)

An analysis is made of ideal free oscillations in a circular synchrophasotron with radial sectors. The derived formulas are used for evaluating geometrical parameters of the accelerator (angular openings and intervals of the sectors, free oscillation frequencies, etc.) and for determining the mean index of the field. (tr-auth)

9003

USE OF PROPER FUNCTIONS IN THE DETERMINATION OF ACCEPTABLE ACCELERATOR MAGNETIC FIELD PARAMETERS. A. A. Kolomenskiĭ and A. P. Fateev (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 22-6(1959) Sept.-Oct. (In Russian)

Proper functions are used in investigating the effects of magnetic field perturbations on betatron oscillations in a cyclotron. The perturbation is differentiated into proper functions (harmonics) of corresponding differential operators and the solution is resolved as a sequence. The method is effective for determining acceptable parameters and developing corrections for field perturbations. (R.V.J.)

9004

THE ESTIMATE OF KLYSTRON BUNCHER FOR LINEAR ELECTRON ACCELERATOR. E. L. Burshteĭn and A. D. Vlasov. Pribory i Tekh. Eksp. No. 5, 26-8(1959) Sept.-Oct. (In Russian)

A method of estimating optimum parameters for a linear electron accelerator klystron buncher which secures the assigned rate of energy dispersion in a maximum of injected particles is suggested. (tr-auth)

9005

BETATRON CONTRACTOR. V. N. Logunov and S. S. Semenov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 5, 122-3(1959) Sept.-Oct. (In Russian)

Descriptions are presented of a beam injector used for securing maximum intensity in a 30-Mev synchrotron. (R.V.J.)

9006

ELECTRON BEAM FOCUSING WITH PERIODIC MAGNET STRUCTURES. Kuo-chu Ho (Nankai Univ.). Wu Li Hsüeh Pao 15, 535-49(1959) Oct. (In Chinese)

The paraxial-ray equation for describing the electron trajectories in a periodic magnetic field was solved by a perturbation method. Space charge effect is included. The cathode may be partially shielded. By this method, it is possible to obtain higher-order approximate periodic solutions as well as the optimum focusing conditions. The beam stability in a periodic magnetic field was studied by a varying amplitude and phase method. Both the space charge effect and the effect of the finite flux at the cathode were considered in the derivation of the stability criteria. In these stability criteria, it is shown that for cases where the cathode is completely shielded the space charge should have no effect on the location of the stability regions as pointed out by earlier authors. It is not true for partially shielded cathode cases. A stability chart is plotted to show how the stability regions are shifted due to the space charge and the amount of flux at the cathode. The perturbation method was applied to treat the problem for focusing electron beams in nonsinusoidal periodic magnetic fields. Both periodic solutions and the optimum focusing conditions were obtained. (auth)

9007

INTERNATIONAL CONFERENCE ON HIGH-ENERGY ACCELERATORS AND INSTRUMENTATION—CERN 1959. PROCEEDINGS. Sponsored by the International Union of Pure and Applied Physics (IUPAP), Geneva, 14th—19th September, 1959. L. Kowarski, ed. Geneva, European Organization for Nuclear Research, 1959. 719p. Sw. Fr. 50.

Papers are presented from the CERN Conference on high-energy accelerators and instrumentation held at Geneva, Sept. 14—19, 1959. Topics include: the need for new particle accelerators; advances in high-energy particle accelerators; fundamental limitations in accelerators; status reports on high-energy accelerators; production, transport, and separation of particles from high-energy machines; large hydrogen bubble chambers; radio electronics for accelerators; propane and other heavy liquid chambers; picture evaluation for track chambers; and counters and other high-energy particle detectors. (W.D.M.)

9008

THE FUTURE OF HIGH ENERGY ACCELERATORS IN PHYSICS. W. K. H. Panofsky (Stanford Univ., Calif.). p.3-6 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Some of the questions concerning the use of ultrahigh-energy accelerators which might be expected to arise in the future are discussed. Various experiments are considered which will require higher energies and higher intensities than are now available. (W.D.M.)

9009

STUDIES AT BERKELEY AND MURA ON FUTURE HIGH ENERGY PROTON ACCELERATORS. D. L. Judd (Univ. of California, Berkeley). p.6-14 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Information from a series of informal meetings at UCRL and MURA on proton accelerators is presented in terms of considerations bearing on the utility of higher currents, factors affecting the desirability of ultrahigh laboratory energies, and features felt to be desirable or essential to planning future accelerators in order to maximize their experimental utility. Some studies recently started at Berkeley to explore the utility of cryogenically cooled magnet coils are briefly discussed. (W.D.M.)

9010

EXPERIMENTAL UTILIZATION OF COLLIDING BEAMS. L. W. Jones (Midwestern Universities Research Assn., Madison, Wis.). p.15-23 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The qualitative features of interactions at high center-of-mass energies as deduced from cosmic ray evidence are briefly reviewed, and the characteristics of colliding-beam devices together with representative working formulas are summarized. The types of possible experiments are discussed in terms of the direct observation of the colliding-beam region and the experiments done with colliding-beam reaction products. (W.D.M.)

9011

EXPERIMENTAL METHODS FOR COLLIDING BEAMS. G. K. O'Neill (Princeton Univ., N. J.). p.23-8 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The designs for colliding beam systems which have been worked on at Princeton are relatively simple and permit a considerable choice of design parameters. Concentric storage rings are considered although the discussion is applicable to most colliding beam devices. Various points are discussed which were considered in deciding on a design approach to colliding beam experiments. (W.D.M.)

9012

RADIAL STRAIGHT SECTIONS IN SPIRAL SECTOR FFAG

ACCELERATORS. F. T. Cole and P. L. Morton (Midwestern Universities Research Assn., Madison, Wis.). p.31-7 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The geometry of RF accelerating cavities in spiral sector accelerators has raised serious problems. If the cavities are introduced along spirals, electric fields perpendicular to the equilibrium orbits are engendered and the resonance excitation of betatron oscillations by the accelerating voltage is greatly enhanced. On the other hand, radial straight sections for RF cavities destroy the scaling properties of the magnetic guide and focusing field. An analytic treatment of the equilibrium orbit motion and linear betatron oscillations for general fields is outlined. The form of the field with straight sections is developed and digital computer evidence relating to results is given. (W.D.M.)

9013

COMPUTATIONAL RESULTS PERTAINING TO USE OF A TIME-DEPENDENT MAGNETIC FIELD PERTURBATION TO IMPLEMENT INJECTION OR EXTRACTION IN A FFAG SYNCHROTRON. L. J. Laslett and K. R. Symon (Midwestern Universities Research Assn., Madison, Wis.). p.38-47 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

In the design of circular accelerators it is often of very great importance to inject efficiently if satisfactory performance is to be achieved, and this aspect of the design warrants explicit attention in consideration of FFAG synchrotrons intended for the production of very high current beams. Attention is directed to a simplified problem which may be considered as the idealization of a possible method for injection into a fixed-field synchrotron, employing a secularly-changing perturbation of the magnetic field but without the intervention of acceleration mechanisms. (W.D.M.)

9014

BEAM EXTRACTION FROM FFAG SYNCHROTRONS. L. W. Jones and K. M. Terwilliger (Midwestern Universities Research Assn., Madison, Wis.). p.48-53 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Two methods of beam extraction from FFAG synchrotrons are considered, a fast pulsed system which brings the beam out in one turn with a high particle density in betatron phase space, suitable for injection into a storage ring, and an adiabatic method, which can give essentially continuous extraction from fixed field synchrotrons with somewhat lower betatron phase space density. (W.D.M.)

9015

COMPARISON OF EXPERIMENTAL RESULTS WITH THE THEORY OF RADIO-FREQUENCY ACCELERATION PROCESSES IN FFAG ACCELERATORS. L. W. Jones, C. H. Pruett, K. R. Symon, and K. M. Terwilliger (Midwestern Universities Research Assn., Madison, Wis.). p.58-70 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A theory of radio-frequency acceleration processes in fixed field acceleration processes in fixed field accelerators was presented at the 1956 CERN Symposium. Additional theoretical results and experiments carried out with the MURA 400-kev radial sector electron accelerator are reported. Phase displacement theory, beam stacking experiments, RF knockout, and capture of particles into a stationary bucket are considered. (W.D.M.)

9016

THE MURA TWO-WAY ELECTRON ACCELERATOR. p.71-4 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A two-beam Ohkawa radial sector FFAG accelerator which will accelerate electrons to approximately 40 Mev is being constructed by MURA. The machine is described in terms of orbit design, magnet design, vacuum tank, injection system, and acceleration system. (W.D.M.)

9017

EXPERIENCE WITH A SPIRAL SECTOR FFAG ELECTRON ACCELERATOR. R. O. Haxby, L. J. Laslett, F. E. Mills, F. L. Peterson, E. M. Rowe, and W. A. Wallenmeyer (Midwestern Universities Research Assn., Madison, Wis.). p.75-81 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A six-sector spiral ridge FFAG accelerator was constructed and successfully operated to accelerate electrons from 35 to 180 kev kinetic energy. Acceleration was by betatron action, supplemented by radio-frequency acceleration when desired. The design was based on magnetostatic and orbit computations, and the subsequent performance was found to be in good accord with these computations. The model has permitted not only the acquisition of design experience and the demonstration of predicted stability regions, but also has afforded the opportunity of studying coupling and multi-particle effects not investigated in detail theoretically. Design and performance are discussed in some detail. (W.D.M.)

9018

TYPICAL DESIGNS OF HIGH ENERGY FFAG ACCELERATORS. F. T. Cole (Midwestern Universities Research Assn., Madison, Wis.). p.82-8 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

FFAG accelerators afford the possibility of high-energy beams of considerably higher intensity than are produced by existing accelerators. Because of the possibility of stacking, there is inherent much more flexibility in duty factor than in pulsed-field accelerators. The MURA work as it affects multi-Bev accelerators is reviewed and designs of interest are summarized. (W.D.M.)

9019

INVESTIGATIONS CONNECTED WITH THE DESIGN OF ACCELERATORS OF THE RING PHASOTRON TYPE. V. N. Kanunnikov, A. A. Kolomenskii (Kolomenskij), A. N. Lebedev, E. P. Ovchinnikov, A. M. Stolov, V. A. Titov, A. P. Fateev, and B. N. Yablokov (Lebedev Inst. of Physics, Moscow). p.89-99 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Investigations are described which were connected with the design of new strong-focusing accelerators with magnetic field constant in time and having high beam intensity. The distinctive and most striking feature of the proposed symmetrical ring phasotron is that it makes possible acceleration, stacking, and head-on collision of two beams of particles rotating simultaneously in opposite directions. The physical considerations involved in the choice of parameters for the phasotron are discussed and the ex-

perimental results obtained from an investigation of its magnet system are described. Possible parameters are given for the magnet system of an electron ring phasotron. (W.D.M.)

9020

STUDIES OF AN EXPERIMENTAL BEAM-STACKING ELECTRON ACCELERATOR. M. Barbier, F. A. Ferger, E. Fischer, P. T. Kirstein, G. L. Munday, M. Morpurgo, M. J. Pentz, A. Schoch, A. Susini, and N. Vogt-Nilsen (European Council for Nuclear Research, Geneva). p.100-14 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

While it has been possible to carry theoretical studies of the processes and phenomena to be expected in a beam-stacking accelerator up to a certain point, there is no doubt that a number of important problems can only be solved by experimental studies with the accelerator itself. This applies particularly to those phenomena which are likely to set the upper limits to the performance. Minimum performance and certain design features required in an accelerator intended for experimental studies of these phenomena are discussed. Results of some of the design studies in progress at CERN are described. (W.D.M.)

9021

CERTAIN BEAM-STACKING EFFECTS IN FIXED-FIELD MAGNETIC SYSTEMS. A. A. Kolomenskii (Kolomenskij) and A. N. Lebedev (Lebedev Inst. of Physics, Moscow). p.115-24 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The investigation of certain properties of a beam of particles in a system with a magnetic field constant in time is considered in which stacking of successive bunches of accelerated particles takes place. Interaction of the stacked beam with the RF accelerating field and space charge effects in the stacked beam are discussed. (W.D.M.)

9022

STORAGE RINGS FOR ELECTRONS AND PROTONS. G. K. O'Neill (Princeton Univ., N. J.). p.124-36 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The Princeton-Stanford colliding-beam experiment using the 500-Mev central beam of the Stanford Mark 3 linac is described. A shielded vault with two storage rings will be used for the colliding-beams. The possibility of transferring and stacking full-energy beam pulses from any accelerator (strong or weak focusing) into storage-ring guide fields made by simple magnet shapes was studied. (W.D.M.)

9023

PLASMA BETATRONS. J. G. Linhart, P. Gratreau, E. R. Harrison, C. Maisonnier, F. Schneider, and A. Schoch (European Council for Nuclear Research, Geneva). p.139-45 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

In connection with the suggestion made by Budker to use the magnetic field of a neutralized pinched relativistic beam as a guide field for high-energy particles, a question which is of interest is whether such currents can be generated by a betatron acceleration of plasma electrons. Plasma betatron studies made at CERN during the last two years are summarized. The various conditions necessary for a betatron acceleration of plasma electrons are discussed briefly and experimental results are described. (W.D.M.)

9024

THE MEGATRON—A HIGH FIELD PLASMA BETATRON. K. C. Rogers, D. Finkelstein, L. Ferrari, D. Caulfield, and I. Mansfield (Stevens Inst. of Tech., Hoboken, N. J.) and G. Brucker (Army Signal Corps Engineering Lab., Fort Monmouth, N. J.). p.145-51 of "International Conference on High-Energy Accelerators and Instrumentation-CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The Megatron is designed to create a 1000 a beam of 150-Mev electrons. A low inductance 10^5 J capacitor bank is charged to 500 kv, then discharged into the field coil, which surrounds a plasma-filled torus. The charged particles are accelerated to peak energy in 6 μs. A general description is given and physical considerations are discussed. (W.D.M.)

9025

AXIAL FIELD PLASMA BETATRON. M. Yoshikawa, T. Ohkawa, and G. Miyamoto (Univ. of Tokyo). p.152-6 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Electrons travel in a spiral motion along the magnetic line of force and gradually drift aside, upwards, or downwards, as a result of curving lines of force. The drifts may be cancelled out after many revolutions around the machine by applying a figure-eight twist to the magnetic line of force. Confinement of charged particles is discussed and the parameters of a model machine which is under construction are given. (W.D.M.)

9026

PLASMA LINEAR ACCELERATOR. H. Ishizuka, T. Ohkawa, G. Miyamoto, T. Nisikawa, and H. Kumagai (Univ. of Tokyo). p.157-9 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

It has been proposed that the coherent interaction between plasmas, and between plasmas and electromagnetic fields, may be used to accelerate charged particles. An experimental method to study the acceleration of a bunch of plasma by the radiation pressure of the electromagnetic wave is considered. The acceleration and stability of the plasma is discussed qualitatively and a brief description of an experimental model is given. (W.D.M.)

9027

ON COHERENT IMPACT ACCELERATION. V. I. Veksler and V. N. Tsytovich (Joint Inst. for Nuclear Research, Dubna, USSR). p.160-6 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A promising variant of coherent acceleration is the so-called impact acceleration, defined as a mechanism in which the peculiarities of collision between bodies moving with relativistic velocities are used for the acceleration of charged particles. As an illustration of the characteristic peculiarities of impact acceleration, the case of collision between a bunch at rest containing ions and a fast moving bunch composed of electrons is proposed. The problem of the determination of the conditions under which the "elasticity" requirement during collision between bunches may be approximately satisfied, i.e., considera-

tion of the role played by the radiation generated during the collision of the bunches, is discussed. (W.D.M.)

9028

PLASMA ACCELERATION IN SLIGHTLY INHOMOGENEOUS HIGH-FREQUENCY FIELDS. M. A. Miller (Gorki Univ., USSR). p.167-77 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Certain peculiarities are discussed of linear and circular high-frequency plasma accelerators of the type in which the same fields of force are utilized both for acceleration and for localization of the objects being accelerated and in which either do not at all ensure localization of the objects undergoing acceleration, or ensure it by means of other fields of force. Evaluations are given of the most important parameters of such accelerators. (W.D.M.)

9029

PLASMA ELECTRODYNAMIC ACCELERATION EXPERIMENTS. I. F. Kvartskhava, R. D. Meladze, and K. V. Sviadze (Technical Inst. of the Georgian Academy of Sciences, Tbilisi, USSR). p.178-83 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The results of experiments on plasma acceleration in two types of accelerators, co-axial and induction, are presented. In the co-axial accelerator, a plasma bunch is first produced by means of an electric discharge struck between two co-axial electrodes. The acceleration is by the self-magnetic field of the current passing the plasma. In the induction accelerator, a plasma is produced by induction, and is accelerated in the inhomogeneous magnetic field, so that a faster rise time is achieved than in the other type of accelerator. (W.D.M.)

9030

ON THE THEORY OF THE STOCHASTIC METHOD OF PARTICLE ACCELERATION AND BEAM STACKING. A. A. Kolomenskii (Kolomenskij) and A. N. Lebedev (Lebedev Inst. of Physics, Moscow). p.184-7 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Some of the relationships for particle motion in a fixed magnetic field are considered for the case when the voltage across the accelerating element is a random function of time having a given spectral intensity. (W.D.M.)

9031

EXPERIMENTS ON STOCHASTIC ACCELERATION. R. Keller (European Council for Nuclear Research, Geneva). p.187-92 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A cyclic accelerator was constructed which produces a continuous extracted beam of protons of 4.4 Mev and an internal beam of the order of 1 μa. This accelerator, which is in some respects similar to a synchrocyclotron, has a diameter of 50 cm. The magnetic field of 14,000 G decreases by 8% from the center of the radius of extraction. Its single electrode in the shape of a D is fed by a high-frequency generator producing 5 kw and 2,000 v. Various characteristics of the machine were measured. (W.D.M.)

9032

MULTIPLE FREQUENCY ACCELERATION. K. W. Robinson (Massachusetts Inst. of Tech., Cambridge and Harvard Univ., Cambridge, Mass.). p.192-5 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A type of accelerator is investigated which consists of a number of radiofrequency voltages, each of a different and constant frequency, in conjunction with a constant magnetic guide field. Some calculations were made on a digital computer with various values of parameters. A 300-Mev electron accelerator and 6-Bev proton accelerator are discussed as examples of multiple frequency acceleration. (W.D.M.)

9033

SCANNING FIELD ALTERNATE GRADIENT ACCELERATORS. T. Kitagaki and J. Riedel (Princeton Univ., N. J.). p.203-5 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The essential feature of the scanning field alternate gradient accelerator (SFAG) is to use a scaling d-c guide field with a gradient, and a scanning quadrupole field giving the opposite gradient for the AG focusing. Because the scanning field need only provide a gradient in the vicinity of the instantaneous orbit, the magnetic energy in this time varying field is quite small compared with the energy of the d-c guide field. (W.D.M.)

9034

A 450 kev EIGHT-SECTOR FIXED-FREQUENCY ELECTRON CYCLOTRON. J. A. Martin (Oak Ridge National Lab., Tenn.). p.205-11 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The new electron analog now being built at ORNL to model a proposed 850-Mev proton accelerator is considered. The analog is being built primarily to study the problem arising in the extraction of a high-quality beam from such a machine using the properties of the 8/4 resonance. It will also be used to investigate any new or unforeseen problems in the design of the full-scale machine. The device will have an eight-sector spiraled magnetic field. (W.D.M.)

9035

1.5 METRE CYCLOTRON WITH AZIMUTHALLY VARYING MAGNETIC FIELD. J. A. Zavenyagin, R. A. Metschcherov, E. S. Mironov, L. M. Nemenov, and J. A. Kholmovskii (Kholmovskij). p. 225-31 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The results of research performed at the Atomic Energy Institute of USSR Academy of Sciences through the period 1954—59 on charged particle motion in azimuthally varying magnetic fields are given. Experiments on the production of a required magnetic field shape were performed with a magnet having a pole diameter of 300 mm. The acceleration of deuterons and H_2^+ ions to an energy of 23.7 Mev in the 1.5 mm AVF cyclotron was recently accomplished. (W.D.M.)

9036

NEW TYPE OF HIGH FREQUENCY ACCELERATING SYSTEM FOR HEAVY PARTICLES IN LINEAR ACCELERATORS. V. F. Trubetskoi (Trubetskoj) (Lebedev Inst. of Physics, Moscow). p.232-4 of "International Conference on High-Energy Accelerators and Instrumentation—

CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A proposed system for high-frequency acceleration of heavy particles in linear accelerators is described. Experimental measurements are summarized. (W.D.M.)

9037

LONGITUDINAL INSTABILITIES IN INTENSE RELATIVISTIC BEAMS. C. E. Nielsen, A. M. Sessler, and K. R. Symon (Midwestern Universities Research Assn., Madison, Wis.). p.239-52 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The influence of space charge forces upon the azimuthal stability of circulating ion beams is considered. The problem treated is the one dimensional azimuthal motion of circulating beams with distribution in momentum and coordinate differing only slightly from certain stationary distributions. (W.D.M.)

9038

ANALYTICAL AND COMPUTATIONAL STUDIES ON THE INTERACTION OF A SUM AND A DIFFERENCE RESONANCE. H. Meier and K. R. Symon (Midwestern Universities Research Assn., Madison, Wis.). p.253-63 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Computed orbits in accelerators near difference resonances, and particularly near the "Walkinshaw resonance," have often shown actual instabilities in addition to the expected strong coupling. The possibility is considered that the paradoxical instabilities may be due to the presence of another nearby resonance in addition to the difference resonance which produces the coupling. An analytical theory of the motion is developed and results of fairly extensive digital computations of orbits are presented. (W.D.M.)

9039

NON-LINEAR THEORY OF BETATRON OSCILLATIONS. Yu. F. Orlov and E. K. Tarasov (Physical Inst. of the Armenian Academy of Sciences, USSR). p.263-74 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Parametric resonances, i.e., resonances caused by a variation of the parameters of the machine, resulting from the coupling of synchrotron and betatron oscillations and so called cylindrical resonances, i.e., resonances on a difference line, are considered when there is an exchange of energy between the r and z directions. (W.D.M.)

9040

LIMITATIONS OF PROTON BEAM CURRENT IN A STRONG FOCUSING LINEAR ACCELERATOR ASSOCIATED WITH THE BEAM SPACE CHARGE. I. M. Kapchinskii (Kapchinskij) and V. V. Vladimirskii (Vladimirskij) (Inst. for Theoretical and Experimental Physics, Academy of Science, Moscow). p.274-88 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

With a given beam current the space charge does not affect the stability of particle motion but determines the beam cross section in the stationary conditions for a definite phase volume of injected particles. Estimates are presented of the dependence of the beam sizes upon the proton current at different values of quadrupole lens focusing fields and phase volumes of the injected particles, taking into consideration the longitudinal particle scattering associated with the presence of synchrotron oscillations in the accelerator. (W.D.M.)

9041

PARTICLE LOSS IN CROSSING A RESONANCE IN A NON-LINEAR SYSTEM. M. Barbier and B. V. Robouch (European Council for Nuclear Research, Geneva). p.289-93 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Crossing of a resonance of a non-linear oscillator was studied experimentally by using a previously described electromechanical model. The results permit some conclusions on the percentage of particles lost by lock-on, as a function of perturbation and rate of change of frequency. Parameters of the system and the procedures used in measurements are discussed. (W.D.M.)

9042

RADIATION EFFECTS IN ELECTRON SYNCHROTRONS. K. W. Robinson (Massachusetts Inst. of Tech., Cambridge and Harvard Univ., Cambridge, Mass.). p.293-7 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The effects of radiation loss on the motion of electrons in a synchrotron may be analyzed as damping or antidamping of the modes of oscillation due to the average radiation loss, and the excitation of the modes of oscillation due to the emission of the radiation of quanta. (W.D.M.)

9043

OBSERVATION OF QUANTUM EFFECTS IN AN ELECTRON SYNCHROTRON. M. Sands (California Inst. of Tech., Pasadena). p.298-302 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Theoretical estimates are given for the rate of loss from synchronism of electrons in a synchrotron with a stationary guide field and with a constant cavity voltage. The results of some new measurements of the observed loss rates are presented. (W.D.M.)

9044

LOSSES OF PARTICLES IN RING ACCELERATORS TAKING DAMPING INTO ACCOUNT. Yu. F. Orlov and S. A. Kheifets (Khejfets) (Physical Inst. of the Armenian Academy of Sciences, USSR). p.303-6 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Damping of oscillations plays an essential role in different stochastic processes bringing losses of particles. In this connection, the study of the particle losses must be carried out taking into account the oscillation damping. The kinetic equations describing the free oscillation amplitude distribution of the particles and the particle losses in the acceleration process are derived. (W.D.M.)

9045

DAMPING OSCILLATIONS IN STRONG-FOCUSING ELECTRON ACCELERATORS. Yu. F. Orlov, E. K. Tarasov, and S. A. Kheifets (Khejfets) (Physical Inst. of the Armenian Academy of Sciences, USSR). p.306-11 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Damping oscillations in strong-focusing electron accelerators are considered in terms of the mechanism of

attenuation of betatron oscillations, attenuation decrements, particle losses due to emission fluctuation, and types of damping. (W.D.M.)

9046

NEUTRALIZED ELECTRON BEAMS AND BUDKER ACCELERATORS. D. Finkelstein (Stevens Inst. of Tech., Hoboken, N. J. and Brookhaven National Lab., Upton, N. Y.). p.312-15 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Budker has suggested a way to make an extremely small-orbit proton accelerator in which a magnetic field of many millions of gauss, produced by a self-focusing (pinched) neutralized electron beam of modest energy, would guide multi-Bev protons in a circle of radius ~1 m. It is proposed that the external field should be AG-focusing, and if either the number of alternations exceeds $\sqrt{\eta\chi}$ or its focusing index exceeds $\eta\chi$, then the neutralized electron beams may be stable against sinuous instability. (W.D.M.)

9047

THE CAPTURE OF ELECTRONS INJECTED INTO THE BETATRON. M. Seidl (Inst. of Vacuum Electronics, Czechoslovak Academy of Sciences, Prague). p.327-31 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Experimental material is presented which makes it possible to form a consistent picture of the mechanism of the capture of injected electrons in the betatron. The described mechanism is directly applicable to continuous injection into fixed-field alternating gradient accelerators. An attempt is made to answer the questions: what kind of electron interaction takes place and what mechanism ensures the capture of electrons. (W.D.M.)

9048

THE CAMBRIDGE ELECTRON ACCELERATOR. p.335-8 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The Cambridge Electron Synchrotron is an alternating-gradient accelerator designed to accelerate electrons to an energy of 6 Bev. It will operate at a repetition rate of 60 pulses per second, with an expected beam intensity of 10^{11} electrons per pulse, or a time-average beam of 1 μa. Design data and construction status are given. The magnets, magnet power supply, injection, the RF system, and vacuum system are discussed. (W.D.M.)

9049

ELECTRON SYNCHROTRON. p.339-42 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

It is planned to build a 6-Bev AG electron synchrotron at Hamburg, similar in design to the accelerator of the MIT-Harvard group. Construction of the machine will be finished about 1963. Design data are given and various components and systems are discussed briefly. (W.D.M.)

9050

7 Gev PROTON SYNCHROTRON (NIMROD). p.343-6 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The 7-Bev proton synchrotron NIMROD now under construction at the Rutherford Laboratory is of the constant gradient type. A major aim of the design is a high intensity output, in the region of 10^{12} protons per second. The target date for assembly is early 1962. Design data are given for the synchrotron and linear accelerator. Progress on principal components is indicated. (W.D.M.)

9051

BROOKHAVEN ALTERNATING GRADIENT SYNCHROTRON. p.347-9 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Construction progress and major component installation are summarized briefly. Design specifications are given. (W.D.M.)

9052

STANFORD TWO-MILE LINEAR ELECTRON ACCELERATOR. p.349-59 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The accelerator will be located in a 10 ft wide tunnel approximately 250 ft underground. Klystrons and power supplies will be situated in a parallel tunnel separated from the accelerator tunnel by 35 ft of earth. The accelerator will be powered by 240 klystrons initially. The evolution of technical specifications is summarized and the present status of component development is given. (W.D.M.)

9053

THE ARGONNE ZERO GRADIENT SYNCHROTRON (ZGS). p.359-61 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The ZGS is a 12-Bev proton synchrotron. It is a weak focusing machine using a uniform magnetic field with the vertical focusing being provided by edge effects. The machine is designed with eight magnet sections, with four short straight sections and four long ones. Ground was broken in June 1959 and it is anticipated that the machine will be completely assembled in June 1962. A general description and design specifications are given. (W.D.M.)

9054

THE PRINCETON-PENNSYLVANIA ACCELERATOR. p.362-5 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The accelerator is a 3-Bev weak focusing, high pulse rate machine (19.0 ± 0.5 per second). Space charge calculations appear to limit the maximum average current to about 0.5 μa which yields a maximum beam power of 1500w. Design specifications are given and the magnet, magnet power supply, vacuum chamber, injection system, radio-frequency, and shielding are discussed. (W.D.M.)

9055

THE SOUTHERN REGIONAL ACCELERATOR. p.366-71 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The Southern Regional Accelerator (SRA), designed to yield a 12-Bev proton beam at very high intensity and low cost, is presently supported only to the extent of funds for computations and model studies. The high intensity is made possible by 850-Mev injection from an AVP cyclotron. Some of the principal parameters for the machine and injector are listed. (W.D.M.)

9056

7 Gev SYNCHRO-PHASOTRON. p.371-2 of "Interna-

tional Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The machine incorporates the Vladimirskii-Tarasov method of removing the transition energy from the working region: one magnet in 8 has normal gradient and no bending field, and the transition energy is about 20 Bev. Frequency tolerances are of the order 10^{-4} at full energy. The main changes of the project which were made during 1956-59 and a short survey of the status as of Sept. 1959 are given. (W.D.M.)

9057

50 Gev SYNCHRO-PHASOTRON. p.373-4 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Some design specifications for the 50-Bev synchrophasotron to be built near Moscow are given. (W.D.M.)

9058

ELECTRON LINEAR ACCELERATORS AT THE RESEARCH INSTITUTE OF PHYSICS OF THE ACADEMY OF SCIENCES OF THE UKRAINIAN SOVIET SOCIALIST REPUBLIC. K. D. Sinelnikov, I. A. Grishaev, C. M. Grizhko, E. V. Eremenko, V. V. Kondratenko, and L. Kh. Kitaevskii (Kitaevskij) (Inst. of Physics, Ukrainian Academy of Sciences, Kiev). p.375-82 of "International Conference on High-Energy Accelerators and Instrumentation-CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Descriptions are given of parameters and designs of two electron linear accelerators operating at the Physical Technical Institute of the Ukrainian Academy of Sciences. On the basis of the experience gathered, conclusions on the choice of some systems for high-energy accelerators are drawn. The accelerators have energy outputs of 30 and 90 Mev. (W.D.M.)

9059

CERN 25 Gev PROTON SYNCHROTRON. p.383-4 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Design specifications and status are given for the CERN 25-Bev proton synchrotron. (W.D.M.)

9060

THE PRODUCTION, TRANSPORT AND SEPARATION OF BEAMS. H. K. Ticho (Univ. of California, Los Angeles). p.387-96 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The characteristics of a beam are strongly influenced by the nature of the investigation for which it is constructed and the research technique which will be used. Of the three most common tools, scintillation counter arrays, bubble chambers, and nuclear emulsions, the requirements of the last are usually less stringent than those of the other two. The characteristic requirements of counter beams are long beam duration and the largest possible flux, while those of chamber beams are short beam duration and sharp images. These two beams are discussed in detail. (W.D.M.)

9061

COSMOTRON BEAMS. L. W. Smith (Brookhaven National Lab., Upton, N. Y.). p.397-400 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The Cosmotron is back in operation after an extended shutdown because of coil failures due to copper fatigue. Modifications to experimental arrangements and facilities accomplished during shutdown are discussed. External beams one, two, and three are considered. (W.D.M.)

9062

NOTES ON EXTERNAL PARTICLE BEAMS FROM THE ARGONNE 12.5 Bev SYNCHROTRON. A. V. Crewe (Argonne National Lab., Lemont, Ill.). p.400-2 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A brief summary is given of beam height, proton beams, meson area, and general facilities. (W.D.M.)

9063

TRANSPORT AND SEPARATION OF BEAMS FROM AG SYNCHROTRON. E. D. Courant and R. Cool (Brookhaven National Lab., Upton, N. Y.). p.403-12 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Beams of various particles at various energies can be produced by placing appropriate targets into the path of the proton beam inside the machine and analyzing and focusing the energetic secondaries by means of bending magnets, quadrupole magnets, and mass separators. Possible layouts of some of these beams are presented, together with some of the considerations that led to the particular choices. (W.D.M.)

9064

A BEAM OF π^- MESONS WITH A MOMENTUM OF 7 Gev/c FROM THE SYNCHRO-PHASOTRON. Wang Tso-tsiang, Ding Da-tsai, V. G. Ivanov, E. N. Kladnitskaya, Nguen Dinh Tu, I. S. Sajtov, M. I. Solov'ev, and M. D. Shafranov (Joint Inst. for Nuclear Research, Dubna, USSR). p.412-14 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

In order to set up a 7 Bev/c π^- beam, trajectories of π^- mesons, emitted from a Be target at an angle of 0^0 with respect to the circulating proton beam, were calculated. The trajectories were obtained with a graphical method and by numerical integration of the equations of motion of a charged particle in an inhomogeneous magnetic field. To focus the beam four quadrupole magnets, each 1 m in length and with an aperture of 30 cm and a maximum field gradient of 600 G/cm, were used. (W.D.M.)

9065

EXTERNAL BEAM PROBLEMS IN THE 6-Bev ELECTRON SYNCHROTRON. M. S. Livingston (Massachusetts Inst. of Tech., Cambridge and Harvard Univ., Cambridge, Mass.). p.414-21 of "International Conference on High-Energy Accelerators and Instrumentation--CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The problems involved in planning for the experimental use of the CEA are surveyed. Properties are analyzed which can be utilized to design systems for expanding or contracting orbits so the electrons can be directed against targets or through deflecting channels. Systems are proposed which utilized the advantageous features of the electron synchrotron. Beam properties, internal targets, emergent electron beams, shielding, and beam channels are considered. (W.D.M.)

9066

A RADIO-FREQUENCY MASS SEPARATOR FOR COMPLETE SEPARATION OF HIGH ENERGY PARTICLE

BEAMS. J. P. Blewett (Brookhaven National Lab., Upton, N. Y.). p.422-7 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

By passing a beam of high-energy particles already analyzed in momentum through a deflector in which a deflecting wave travels with the beam, it is possible to reduce the relative intensity of an undesired particle component. This is accomplished by matching the velocity of the traveling wave to the velocity of the unwanted particles. The desired particles have a different velocity and will then fall out of step with the deflecting field so that they experience less total deflection. It is shown that two such deflectors can give complete separation of two particle types. The problem of removing the π meson component from a beam of antiprotons is considered. (W.D.M.)

9067

BEAMS FROM HIGH ENERGY LINEAR ACCELERATORS. W. K. H. Panofsky (Stanford Univ., Calif.). p.427-8 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Some general remarks are presented about the properties of beams from high energy linacs and the experimental utilization of these beams. The particular features of linac beams are summarized. (W.D.M.)

9068

EXPERIENCE WITH A MICROWAVE SEPARATOR. W. K. H. Panofsky (Stanford Univ., Calif.). p.428-31 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A microwave separator was designed, constructed, and tested in connection with the Stanford Mark III 700-Mev linear accelerator. Results of this work are summarized. (W.D.M.)

9069

BERKELEY 72" HYDROGEN BUBBLE CHAMBER. J. D. Gow and A. H. Rosenfeld (Univ. of Calif., Berkeley). p.435-9 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The 72" liquid hydrogen bubble chamber came into operation at UCRL in March 1959, approximately five years after its conception. The cost of all engineering, materials, equipment, and assembly amounted to $\$1.4 \times 10^6$. A location with respect to the Bevatron target area was chosen such that beams of particles with momenta ranging from 400 Mev/c to 5 Bev/c could be brought easily into the chamber building. Brief descriptions of the major components of the bubble chamber are given. (W.D.M.)

9070

DISCUSSION ON BROOKHAVEN 20-INCH AND 80-INCH HYDROGEN CHAMBERS. D. C. Rahm (Brookhaven National Lab., Upton, N. Y.). p.440-2 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A liquid hydrogen bubble chamber of dimensions 20" × 9" with a depth of 10" has been put into operation. The chamber has performed well with an expansion ratio of 0.8% at temperatures as low as 25.5°K with chamber operating pressures of 55 psia and higher. A chamber of nominal dimensions 80" × 25", with a 28" depth, is in the design stage. (W.D.M.)

9071

HIGH FIELD BUBBLE CHAMBER. W. H. Bergmann (Max-Planck-Institut für Physik, Munich). p.442-4 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Ideas are presented on how to approach the technically difficult task of constructing a high field bubble chamber. After careful study of the available data it has been concluded that it is technically feasible to construct a bubble chamber operating in a pulsed field of 100,000 to 300,000 gauss, the latter figure giving the approximate upper limit of the attainable field strength. (W.D.M.)

9072

SOME FEATURES OF THE BRITISH NATIONAL HYDROGEN BUBBLE CHAMBER. L. Riddiford and H. B. Van de Raay (Birmingham Univ., Eng.); N. C. Barford, C. C. Butler, D. McMullan, A. Thetford, D. B. Thomas, and W. T. Welford (Imperial Coll., London); A. Amery, W. H. Evans, M. J. Moore, P. Polak, H. W. B. Skinner, and P. R. Williams (Liverpool Univ.); D. Shaw (Oxford Univ.), and A. G. Ashburn and M. Snowden (Rutherford Lab., Harwell, Eng.). p.445-54 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The principal features of the 150 × 50 × 45 cm hydrogen and deuterium bubble chamber to be constructed at the Rutherford Laboratory are given. A magnetic field in excess of 10,000 gauss is to be utilized. Special features require the use of a horizontal expansion system, and design criteria are discussed. (W.D.M.)

9073

SOME FEATURES OF CERN HYDROGEN BUBBLE CHAMBERS. Ch. Peyrou (European Council for Nuclear Research, Geneva). p.454-9 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Experiments with a 30 cm hydrogen bubble chamber are described which were performed in order to foresee the future performance of the CERN 2 m bubble chamber. The 2 m chamber is described. (W.D.M.)

9074

9 in. HYDROGEN BUBBLE CHAMBER IN A PULSED MAGNETIC FIELD. G. A. Doran, J. G. Hill, J. B. Kinson, and L. Riddiford (Univ. of Birmingham, Eng.). p.460-60a of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

An air-cored magnet with the copper as close to the chamber as possible is used to provide the field. The generator is a 500 kw d-c machine which is pulsed to about 1.5 Mw yielding a maximum field of 22 kG in a pulse about 2 seconds long. (W.D.M.)

9075

A LIQUID HELIUM BUBBLE CHAMBER. M. M. Block, W. M. Fairbank, E. M. Harth, T. Kikuchi, C. Meltzer, and J. Leitner (Duke Univ., Durham, N. C.). p.461-5 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The Duke University helium bubble chamber has been operating successfully for over a year in the pion and K^- meson beams of the Bevatron. Some of the more important details of design and the operating characteristics of this

chamber are presented. The chamber has an active volume of 3 liters; it is approximately rectangular measuring about 8 in. × 5 in. × 4 in. It is operated in a steady magnetic field of 14.3 kilogauss provided by a pair of Helmholtz coils. (W.D.M.)

9076

MINIMIZING FRONT GLASS REFLECTIONS IN RETRODIRECTIVE ILLUMINATION OF BUBBLE CHAMBERS. H. Courant (Brookhaven National Lab., Upton, N. Y.). p.465-6 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Bubble chambers utilizing a retrodirective illumination scheme generally present some difficulties in their photography because the light source is visible to the cameras through a reflection in the glass window of the chamber. A method for minimizing these reflections is proposed. (W.D.M.)

9077

ON A METHOD OF MEASURING FREQUENCY MICROMODULATION OF THE PROTON SYNCHROTRON ACCELERATING FIELD. N. L. Sossenskii (Sossenskij). p.469-70 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

In modern proton synchrotrons with strong focusing, very strict requirements are made for spurious frequency modulation of the frequency program with frequencies similar to those of synchrotron oscillations. A method is proposed for measuring small accelerating voltage frequency deviations from a given program of frequency variation, i.e., the measurement of frequency micromodulation under dynamic conditions. (W.D.M.)

9078

METHOD AND DEVICES FOR INVESTIGATIONS ON ACCELERATED BEAM PARTICLES IN THE CHAMBER OF THE 10 Gev PROTON SYNCHROTRON. F. A. Vodop'yanov, A. A. Kuzmin, S. M. Rubchinskii (Rubchinskij), and V. A. Uvarov (Joint Inst. for Nuclear Research, Dubna, USSR). p.470-7 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

During preparation of the 10-Bev proton synchrotron at Dubna special attention was paid to the development of electronic equipment to obtain continuous information about the intensity of beam, its position relative to the central orbit, azimuthal distribution of the particle density in the bunch, and oscillations of the accelerated bunch relative to the equilibrium phase. Two pairs of stainless steel electrodes were installed in the ejection straight section of the chamber. Two rectangular electrodes placed one on top and another in the bottom of the ejection sections were designed to measure the intensity and vertical displacement of the beam. Two triangular electrodes, placed symmetrically relative to the vertical plane passing through the central orbit, were designed to indicate radial displacement of the beam. (W.D.M.)

9079

DESIGN PRINCIPLES OF THE ELECTRONICS SYSTEM FOR THE 50-60 Gev STRONG FOCUSING PROTON SYNCHROTRON. A. L. Mints, A. A. Vasil'ev, F. A. Vodop'yanov, A. A. Kuzmin, V. F. Kuzmin, and S. M. Rubchinskii (Rubchinskij). p.477-84 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Design principles of the electronics system of the 50-Bev proton synchrotron are discussed in terms of program frequency control system, injection and acceleration control system, measuring radio equipment, measuring devices, and indication of beam parameters by means of electrostatic electrodes. (W.D.M.)

9080

REMARKS ON THE PHASE LOCK SYSTEM OF THE CERN PROTON SYNCHROTRON. W. Schnell (European Council for Nuclear Research, Geneva). p.485-90 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

In the CERN PS the variation of phase shift with frequency amounts to more than 20 π during acceleration. To overcome this difficulty, the phase between pick-up electrode and gap is kept constant by means of a servo system. A phase discriminator measures the phase error between pick-up and gap and the error signal acts on the frequency of an FM oscillator which feeds the cavities. An automatic phase correction servo loop is thus formed, locking the accelerating wave to the rotation of the bunches. Such a system ensures that the center of azimuthal charge distribution of the bunch passes the gap at a fixed phase with respect to the accelerating voltage. (W.D.M.)

9081

INTERPRETATION OF RESULTS FROM PROPANE AND OTHER HEAVY-LIQUID CHAMBERS. W. M. Powell (Univ. of California, Berkeley). p.493-9 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A brief outline is given for work on bubble chambers for liquids heavier than hydrogen. A more detailed description is presented on the use of information obtained from a large propane chamber and from Glaser's xenon chamber. These were chosen so as to give the two extremes in liquids heavier than hydrogen. Current experiments and methods of interpretation are discussed. (W.D.M.)

9082

PROPANE AND HEAVY LIQUIDS BUBBLE CHAMBERS AT THE ECOLE POLYTECHNIQUE, PARIS. M. Bloch, A. Lagarrigue, P. Musset, P. Rancon, A. Rousset, X. Sauteron, and J. Six (Ecole Polytechnique, Paris). p.499-503 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

After the construction of a small experimental bubble chamber in 1957, the Ecole Group built a 20 l chamber, which was recently operated in connection with the 1-Bev π^- beam of the Saclay Synchrotron. Construction of a larger chamber ($100 \times 50 \times 50$ cm^3) which will be operated in a 20 kG magnetic field is discussed. (W.D.M.)

9083

WINDOW SAFETY PROBLEMS IN BUBBLE CHAMBERS. J. C. Street (Harvard Univ., Cambridge, Mass.). p.503-5 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The usual bubble chamber window design provides for a safety box to contain the propane as well as the fragments of flying glass in case the window breaks. Some recent observations of the dynamic pressure changes which take place when the window breaks are summarized. Windows of ⅛ and ⅜ in. plate glass, a small model chamber, and safety box were used. (W.D.M.)

9084

A SCINTILLATION PROPANE BUBBLE CHAMBER. K. Strauch (Harvard Univ., Cambridge, Mass.). p.505-6 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The operation of a propane bubble chamber simultaneously as a bubble chamber and as a counter is briefly discussed. A number of bubble-chamber-counter triggered photographs of cosmic ray tracks were made. (W.D.M.)

9085

STABILIZATION AND CONTROL OF BUBBLE CHAMBER SENSITIVITY. B. Hahn and A. W. Knudsen (Université, Fribourg, Switzerland). p.506-7 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The bubble density of a bubble track is known to depend strongly on the liquid temperature and on the pressure drop. Pressure stabilization by providing pressure communication of the chamber liquid with a reference pressure through flexible membranes is discussed. (W.D.M.)

9086

A 30 LITER XENON BUBBLE CHAMBER. T. I. Kanarek, E. I. Maltsev, T. Nagy, J. Nagy, A. Prokeš, G. M. Stashkov, E. P. Ustenko, I. V. Chuvilo, and U. N. Shkobin (Joint Inst. for Nuclear Research, Dubna, USSR). p.508-10 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A 30 l liquid xenon bubble chamber is described which was constructed at Dubna. The working volume has a rectangular form, the dimensions of the illuminated region being $55 \times 28 \times 16$ cm^3. Photographing is performed from above, expansion and illumination through the lateral long sides. The chamber is made of non-magnetic materials and is placed in a magnetic field of 13 kOe. (W.D.M.)

9087

THE USE OF XENON—FREON AND XENON—PROPANE MIXTURES FOR BUBBLE CHAMBERS. Ya. Ya. Shalamov and V. A. Shebanov (Inst. of Theoretical and Experimental Physics, USSR Academy of Sciences, Moscow). p.510-12 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Several experiments were made using mixtures of xenon with different substances in a bubble chamber, searching for substances with large Z, which are non-corrosive and non-toxic, and operating at room temperature. Successful were the mixtures of xenon with Freon-12 (CCl_2F_2) and xenon with propane. The mixture characteristics at an operating temperature of 25°C are given. (W.D.M.)

9088

A 570 LITER FREON BUBBLE CHAMBER. A. I. Alikhanyan, M. M. Veremeev, A. M. Galper, W. G. Kirillov-Ugrumov, L. P. Kotenko, L. A. Kusin, E. P. Kuznetsov, and U. S. Popov (Lebedev Inst. of Physics, Moscow). p.512-13 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A bubble chamber with a 570-l sensitive volume (90 cm long by 90 cm in diam.) filled with a Freon mixture (CCl_2F_2, 40%; $CClF_3$, 60%) and operating near room temperature was constructed. Features and operation of the chamber are briefly discussed. (W.D.M.)

9089

A BUBBLE CHAMBER IN A PULSED MAGNETIC FIELD. K. N. Mukhin, R. S. Shlyapnikov, and L. M. Barkov (Inst. of Atomic Energy, Academy of Sciences, Moscow). p.514-19 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The design of a 10-liter propane bubble with a pulsed 10 kG magnetic field is described. The device consists of the bubble chamber with auxiliary equipment, a system for producing the pulsed magnetic field, and a control circuit for the chamber and the pulsed magnetic field. (W.D.M.)

9090

INSTRUMENTS FOR PICTURE EVALUATION: A SURVEY. Y. Goldschmidt-Clermont (European Council for Nuclear Research, Geneva). p.523-32 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The basic instrument in picture evaluation is a digitized projector used to record co-ordinates of points, selected by the observer, on punched paper. This step in the conversion of the information is followed by a number of data processing operations performed by the computer. Other approaches to the problem are discussed. (W.D.M.)

9091

DIGITAL COMPUTER ANALYSIS OF DATA FROM HYDROGEN BUBBLE CHAMBERS AT BERKELEY. A. H. Rosenfeld (Univ. of California, Berkeley). p.533-41 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The method by which track co-ordinates are obtained is described. A discussion as to how they are then synthesized into tracks, vertices, events, and experiments is presented. (W.D.M.)

9092

INSTALLATION FOR AUTOMATIC MEASURING OF PHOTOGRAPHS FROM BUBBLE CHAMBERS. E. M. Andreev, P. Giršl, I. A. Zarubin, G. M. Kadykov, S. M. Korenchenko, V. M. Lachinov, A. G. Morozov, K. G. Nekrasov, R. Pose, M. I. Popov, V. V. Smirnov, and N. S. Tolstoj (Joint Inst. for Nuclear Research, Dubna, USSR). p.541-3 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The described instrument for automatic measuring of photographs (AOC) is designed to measure precisely co-ordinates of points on particle tracks on bubble chamber photographs. The measured co-ordinates are recorded on punched paper tape so that they can be read directly into the electronic computer for mathematical processing. (W.D.M.)

9093

AN INSTRUMENT FOR AUTOMATIC BUBBLE CHAMBER PHOTOGRAPH EVALUATION. V. S. Kaftanov, J. L. Lichtenbaum, B. N. Moiseev, S. Ya. Nikitin, and O. P. Fedotov (Inst. for Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.550-2 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

An instrument is described for automatic evaluation of bubble chamber photographs. The instrument allows the measurement of the co-ordinates of a number of points of the track on individual stereoscopic projections and the recording of these measurements in a form suitable for further handling by a computer. (W.D.M.)

9094

BROOKHAVEN BUBBLE CHAMBER DATA HANDLING EQUIPMENT. R. R. Rau (Brookhaven National Lab., Upton, N. Y.). p.552-4 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

During the construction of the 20 in. hydrogen bubble chamber at Brookhaven, a parallel effort was made toward setting up data handling facilities for the film from this chamber. Progress made in the areas of scanning, measuring, and programming is summarized. (W.D.M.)

9095

MACHINE ANALYSIS OF BUBBLE CHAMBER PICTURES. P. V. C. Hough (Univ. of Michigan, Ann Arbor). p.554-6 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

It is shown that the tracks in one picture may be recognized in a time of the order of 1 to 2 seconds, and therefore a stereo pair of pictures may be analyzed in less than 5 seconds. It seems that an analysis time of this order of magnitude is a reasonable goal since it matches the cycle time of large accelerators. Progress on a program to realize this goal is summarized. (W.D.M.)

9096

A ROTARY DIGITIZER FOR USE WITH A FILM MEASURING MACHINE. M. Derrick, T. Fields, and R. Findley (Carnegie Inst. of Tech., Pittsburgh). p.557 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A rotary digitizer attached to the micrometer screw of a microscope stage was used to measure, display, and record the cartesian co-ordinates of points on bubble chamber film. The system uses electronic counting circuitry of exactly the same type as is used in Moiré fringe digitizers. (W.D.M.)

9097

THE LUMINESCENT CHAMBER AND OTHER NEW DETECTORS. L. W. Jones and M. L. Perl (Univ. of Michigan, Ann Arbor). p.561-70 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

It is now possible to record photographically single photons of optical wavelength using image intensifier vacuum tubes. This makes possible the luminescent chamber wherein tracks of ionizing particles in scintillators are recorded with a spatial resolution approaching that of graphical detectors and a time resolution characteristic of particle counters. Requirements, image tube systems, particle track photography, utility of the luminescent chamber, future of the luminescent chamber, and other detectors are discussed. (W.D.M.)

9098

CONSTRUCTION OF A LUMINESCENT CHAMBER AT THE PHYSICAL INSTITUTE OF BONN. R. Giese, O. Gildemeister, and W. Paul (Universität, Bonn). p.571-2 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Design specifications are given for an image intensifier being built in conjunction with a luminescent chamber for the 500 Mev Bonn electron synchrotron. (W.D.M.)

9099

SCINTILLATION CHAMBER WORK AT M.I.T. H. S. Bridge, H. C. Burrowes, D. O. Caldwell, D. A. Hill, and R. A. Schluter (Massachusetts Inst. of Tech., Cambridge). p.572-5 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A brief report is given on the current status of the work on fiber scintillation chambers which is going on at MIT. The initial objective was to demonstrate the feasibility of scintillation chambers made of plastic fibers. A system employing a chamber $5 \times 5 \times 10$ inches and capable of resolving about 1 mm is described. (W.D.M.)

9100

FILAMENT SCINTILLATION CHAMBERS. G. T. Reynolds (Princeton Univ., N. J.). p.576-9 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Some of the work conducted at Princeton on filament properties is reported and the results obtained with various filament scintillation chambers are discussed. (W.D.M.)

9101

A COUNTER CONTROLLED CLOUD CHAMBER TRIGGERING ON RARE EVENTS IN THE SYNCHRO-PHASOTRON BEAM. N. M Viryasov, G. G. Vorob'ev, Kim Khi In, L. N. Strunov, and I. V. Chuvilo (Joint Inst. for Nuclear Research, Dubna, USSR). p.580-1 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A technique is described for the study of processes taking place in the interaction of fast antiprotons with the matter of solid targets. A counter controlled cloud chamber is used which is triggered by an antiproton passing through a coincidence circuit. The cloud chamber is $50 \times 50 \times 15$ mm^3 in a field of 16.5 kOe and is filled with He to a pressure of 2.8 atm. (W.D.M.)

9102

THE COUPLING OF COUNTER EXPERIMENTS TO COMPUTERS. C. Wiegand (Univ. of California, Berkeley). p.581-8 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The object of the Berkeley work is to couple each element of a counter array to a storage device in order that electronic computers can be employed to sort, tabulate, and analyze the data. The information can be conveniently stored by devices that are in daily use in almost any large laboratory. A prototype system, design requirements, data storage system, applications, and testing are discussed. (W.D.M.)

9103

HODOSCOPIC SYSTEMS OF GAS-DISCHARGE COUNTERS USED IN EXPERIMENTS WITH ACCELERATORS. I. M. Vasilevskii (Vasilevskij), V. V. Vishnyakov, E. Iliescu, and A. A. Tyapkin (Joint Inst. for Nuclear Research, Dubna, USSR). p.589-91 of "International Conference on High-Energy Accelerators and Instrumentation–CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Hodoscopic systems of gas-discharge counters for application to accelerator experiments are discussed. Investigations carried out with the synchrocyclotron of the JINR are described. Experiments on $\pi^- + p$ and $p + p$ scattering were accomplished. (W.D.M.)

9104

GAS CHERENKOV COUNTERS. M. Deutsch (Massachusetts Inst. of Tech., Cambridge). p.593-9 of "Interna-

tional Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The theory of Cherenkov counters is briefly reviewed and the advantages of using gases are discussed. Two counters which have been used successfully are described. The first of these is a threshold counter developed at UCRL and used for threshold values $0.980 < \beta < 0.99$. The second device is a differential focusing counter constructed at MIT to be used in the range $0.78 < \beta < 0.999$ for separating K particles from pions and protons. (W.D.M.)

9105

HOW MUCH DO WAVELENGTH SHIFTERS USED FOR CHERENKOV COUNTERS SCINTILLATE? G. Finocchiaro, R. Finzi, and L. Mezzetti (Università, Rome). p.599-600 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The addition of wavelength shifters to liquid Cherenkov counters to improve the resolution is discussed. Results of tests on β-methyl umbelliferone in water are given. (W.D.M.)

9106

APPLICATIONS OF TRANSISTORS IN COUNTER EXPERIMENTS. V. L. Fitch (Princeton Univ., N. J.). p.601-4 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Transistorized circuits for pulse height discrimination and coincidence are briefly described. Two multiple channel detectors are discussed. (W.D.M.)

9107

A NANOSECOND COINCIDENCE CIRCUIT USING TRANSISTORS. A. Barna, J. H. Marshall, and M. Sands (California Inst. of Tech., Pasadena). p.604-14 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Most of the experiments at the Cal. Tech. electron synchrotron which use scintillation and Cherenkov counters require coincidence circuits with a resolving time of a few nanoseconds. With the advent of the Philco 2N501 transistor, which has a characteristic response time faster than the usual vacuum tubes, it became possible to consider constructing transistor coincidence circuits with resolving times limited by the response of the scintillation counters. A two-fold coincidence circuit is described. (W.D.M.)

9108

TRANSISTOR GATES. R. M. Littauer (Cornell Univ., Ithaca, N. Y.). p.615-18 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Some measurements on simple transistor gating circuits are described. Both series and parallel gates were treated. (W.D.M.)

9109

INJECTION OF PARTICLES INTO A STRONG FOCUSING ACCELERATOR. A. Ts. Amatuni, R. V. Tevikyan, H. V. Badalyan, Yu. F. Orlov, M. V. Kharitonov, and S. A. Kheifets (Khejfets) (Physical Inst. of the Armenian Academy of Sciences, USSR). p.621-5 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

For the effective capture of particles into a synchrotron in the case of a single turn injection, it is necessary that the switching-off time of the inflector field should be much less than the duration of a single turn. If the perturbation which acts on the captured particles is studied, it is found that in the case of a strong focusing accelerator the tolerance on the magnitude of the residual inflector field is severe. Tolerances are calculated. (W.D.M.)

9110

APPLICATION OF THE METHOD OF SUCCESSIVE APPROXIMATIONS TO A CALCULATION OF CAVITY RESONATORS FOR LINEAR ACCELERATOR OF PROTONS. V. G. Andreev. p.626-30 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The solution of a wave equation for resonators of complicated shape, including a toroidal resonator which is a separate compartment of a cavity resonator with drift tubes, is represented by Fourier-Bessel series. The wave equation transformed into an infinite transcendental system of equations is solved by the method of successive approximations by means of specifying the field in the resonator and wave number. (W.D.M.)

9111

FERRITE MODULATION SYSTEM DESIGNED FOR OPERATING A FIXED-FREQUENCY CYCLOTRON IN AN FM MODE. A. V. Antonov, U. V. Korshunov, E. A. Meleshko, L. M. Nemenov, and V. S. Panasyuk (Atomic Energy Inst., Academy of Sciences, Moscow). p.631-6 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Calculations indicate that in a cyclotron of 1200 mm pole diameter, and with the magnetic field uniform to within 2%, the necessary frequency deviation at 30 Mev is about 5%. The capture efficiency with an accelerating voltage of 25 kv is 10%. To check experimentally the operation of such a machine, the necessary equipment and ferrite-loaded system were fabricated for the 1.5 m cyclotron of the Atomic Energy Institute. Equipment tests were performed using the magnetic field and frequency parameters normally used for deuteron acceleration. (W.D.M.)

9112

PASSAGE OVER TRANSITION ENERGY BY MEANS OF STOCHASTIC ACCELERATION. M. Barbier (European Council for Nuclear Research, Geneva). p.636-9 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

In alternating gradient machines, passage over transition energy gives rise to the loss of phase stability. To overcome this difficulty, an acceleration system should be found which will work only because there is a transition energy, i.e., an energy for which the revolution time of the particle around the machine is independent of energy and consequently constant during a certain time. A stochastic scheme for the acceleration, which does not need phase stability, is investigated. (W.D.M.)

9113

PRODUCTION OF VERY STRONG PULSED MAGNETIC FIELDS AND THEIR POSSIBLE APPLICATION. L. M. Barkov, K. N. Mukhin, and R. S. Shlyapnikov (Inst. of Atomic Energy, Academy of Sciences, Moscow). p.640-3 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Two pulsed magnetic field devices are described. The description of a propane bubble chamber operating in a field of 60 kOe shows that a mechanically strong bubble chamber, suitable for long time operation in a strong pulsed magnetic field, can be constructed. A draft design is presented of a solenoid coil with an internal copper "concentrator" allowing the concentration of the magnetic field inside a relatively small space. (W.D.M.)

9114

A LINEAR ACCELERATOR OF MULTI-CHARGED IONS. L. I. Bolotin, E. I. Revutskii (Revutskij), L. L. Chernyak, V. A. Bomko, Y. F. Kulygin, V. M. Ovsyannikov, and V. A. Suprunenko (Physical Technical Inst., Ukrainian Academy of Sciences, Kharkov). p.643-4 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

A brief description is given of a 10-Mev multi-charged ion accelerator built at the Kharkov Academy of Science. Tetra-charged carbon ions, tetra-charged nitrogen ions, and penta-charged oxygen ions can be obtained. (W.D.M.)

9115

STRONG FOCUSING IN LINEAR ACCELERATORS. L. I. Bolotin, E. I. Revutskii (Revutskij), and V. A. Suprunenko (Physical Technical Inst., Ukrainian Academy of Sciences, Kharkov). p.644-52 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The problem of applying strong focusing to proton linear accelerators is considered. A detailed quantitative analysis of proton motion in the system is given. Methods of engineering calculation and the design of quadrupole lenses are elaborated. Experimental results of applying strong focusing in a 5.5-Mev proton linear accelerator are given. (W.D.M.)

9116

GAS-SCATTERING IN STRONG-FOCUSING ACCELERATORS. L. L. Gol'din and R. A. Ioffe (Inst. for Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.653-5 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The calculations of losses associated with gas scattering were previously carried out for both the usual and strong focusing accelerators. Losses for the strong focusing accelerators are recalculated taking into account the adiabatic damping of oscillation during acceleration. (W.D.M.)

9117

BEAM INJECTION INTO A 50 Gev STRONG-FOCUSING PROTON SYNCHROTRON. D. G. Koshkarev (Inst. for Theoretical and Experimental Physics, Academy of Sciences, Moscow). p.656-9 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The effectiveness of injection depends largely on the beam characteristics at the outlet of the injector, a linear accelerator. The ion guide, injection, and injector design are discussed. Some beam characteristics at the linear accelerator outlet and in the ring accelerator chamber at the moment of injection are given. (W.D.M.)

9118

REFLECTION OF ELECTROMAGNETIC WAVES FROM MOVING SURFACES. V. I. Kurilko (Physical Technical Inst., Ukrainian Academy of Sciences, Kharkov). p.660-1 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The reflection of an electromagnetic wave from a moving surface involves a double Doppler effect: the amplitude and frequency is changed upon reaching and leaving the surface. The effects of multiplying the frequency and the amplitude of the wave may be increased considerably by means of multiple reflection. The quantitative analysis of the effects relative to multiple reflection is considered. (W.D.M.)

9119

THE MOTION OF CHARGED PARTICLES IN SLIGHTLY INHOMOGENEOUS HIGH-FREQUENCY FIELDS. M. A. Miller (Gorki Univ., USSR). p.662-9 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The non-relativistic movement of a particle in an external magnetic field is considered. Averaged equations of motion in monochromatic and in multi-frequency fields are derived. The integral of average energy and possible applications are discussed. (W.D.M.)

9120

EXPERIMENT ON EXCITATION OF POWER OSCILLATIONS ON METER WAVES IN A TOROIDAL CAVITY RESONATOR PLACED IN VACUUM. B. J. Polyakov, B. T. Zarubin, and V. V. Kushin (Radiotechnical Inst., Academy of Sciences, Moscow). p.670-3 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

For a rational choice of accelerating voltage gradients in a proton linear accelerator it is necessary to have information on the electrical strength of accelerating gaps. Experiments on the mechanism of high-frequency discharge in vacuum are described. The experimental device used a cylindrical toroidal resonant cavity with a 4 cm gap between the drift tubes. The cavity is excited by oscillations at a frequency of 99 megacycles running at 750 μs pulses. (W.D.M.)

9121

COHERENT FORCES IN A BUNCH OF RELATIVISTIC ELECTRONS. M. S. Rabinovich and L. V. Iogansen (Lebedev Inst. of Physics, Moscow). p.673-80 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Electron interaction forces and the power of coherent radiation for revolving relativistic electron bunches are calculated taking into account the shielding effect of the chamber walls. The effect of shielding is approximately taken into account since it is assumed that the bunch moves between two perfectly conducting infinite planes. (W.D.M.)

9122

SOME ASPECTS OF THE THEORY OF CYCLIC WAVEGUIDE ELECTRON ACCELERATORS. A. A. Vorob'ev, A. N. Didenko, E. S. Kovalenko, and B. N. Morozov. p.680-5 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

The application of corrugated waveguides in accelerator technique may be of double interest. First, at high energies there is some sense in uniting individual resonators into one resonance system with the help of waveguides. It

is clear that such a system strongly resembles a linear accelerator bent into a ring, and therefore it is of interest to find out the implications of the use of corrugated waveguides in place of a number of coupled resonators. Secondly, due to the fact that all wave components are excited in the waveguide, it is of interest to study the problem of simultaneous guiding and acceleration of particles with the high frequency field. These two problems are treated. (W.D.M.)

9123

EXPERIMENTAL RESEARCH OF PLASMA WAVEGUIDE PROPERTIES AND ELECTROMAGNETIC WAVE REFLECTION FROM PLASMA MOVING IN A SLOW WAVEGUIDE. O. G. Zagorodnov, Ya. B. Fainberg, A. M. Egorov, and A. F. Kivshich. p.685-93 of "International Conference on High-Energy Accelerators and Instrumentation—CERN 1959." Geneva, European Organization for Nuclear Research, 1959.

Dispersion properties of a plasma waveguide and electrical field topography in such waveguides were investigated. Experiments were carried out on particle acceleration in a plasma-helix waveguide. Some non-linear effects were considered which are present in the case of low frequency wave propagation in plasma. An experimental investigation was made of a slow electromagnetic wave reflection on a moving plasma. (W.D.M.)

Plasma Physics and Thermonuclear Processes

9124 AD-217607

Michigan. Univ., Ann Arbor. Radiation Lab.

PARTIAL SUMMARY OF PRESENT STATUS OF ATTEMPTED DEDUCTION OF BOLTZMANN-TYPE EQUATION FOR PLASMAS. Quarterly Status Report No. 3 [for] October 1 to December 31, 1958. R. K. Osborn. Jan. 6, 1959. 25p. Contract AF33(616)-5585.

The format and method of approach to deduction of a Boltzmann-type equation for the description of plasma dynamics are outlined. It is the aim of the research to state axioms such that by strict deduction, a precisely delineated, reasonably tractable description of a system comprising many particles can be formulated. (J.R.D.)

9125 AD-225981

California Inst. of Tech., Pasadena. Electron Tube and Microwave Lab.

PLASMA INTERACTION RESEARCH PROJECT QUARTERLY STATUS REPORT NO. 2 [FOR] MARCH 1, 1959 TO MAY 31, 1959. Roy W. Gould and Daniel G. Dow. 25p. Contract DA-36-039-SC-78230.

Theoretical studies of plasma modes were held up during the report period; however, formulas for use in matching boundary conditions in finite-sized plasma columns are presented. Design of an apparatus for use in experimental studies of plasma modes is described, and results of measurements made with the apparatus at various arc currents are presented. Theory of attenuation in plasma is discussed, and information on electron collision with the ion sheath is given. Completion of the traveling wave amplifier is reported. Search for backward wave interaction was continued, various difficulties are described, and several approaches are programmed for trial. The forward wave interaction was observed to move in the proper direction. Factors associated with plasma scaling laws are discussed, and the feasibility of the plasma traveling-wave tube is evaluated. (J.R.D.)

9126 AD-227232

Stevens Inst. of Tech., Hoboken, N. J.

INVESTIGATION OF PLASMA ACCELERATION. Quarterly Progress Report No. 4 [for] April 1, 1959—June 30, 1959. K. C. Rogers, D. Finkelstein, G. Brucker, L. Ferrari, I. Mansfield, and D. Caulfield. 20p. Sponsored by AEC and Army Signal Supply Agency under Contract DA 36-039SC-78097. OTS.

Research and development of a machine designed to create a 1000 ampere beam of 150-Mev electrons are discussed. A low-inductance 10^5 joule capacitor bank is charged to 50 kv, then discharged into a field coil, which surrounds a plasma-filled torus. The charged particles are accelerated to peak energy in 6 microseconds. Physical considerations of megatron design such as energetics of relativistic electron acceleration, betatron magnetic field shaping, plasma injection, capacitor and bank switches, field coil parameters, and collision and radiation losses are discussed. A search for a low-energy beam is scheduled. It is noted that the peak energy of 150 Mev may be a dangerous source of radiation. (For preceding period see AECU-4344.) (J.R.D.)

9127 AFOSR-TR-59-92

Oslo. Universitetet. Institutt for Teoretisk Astrofysikk.

THEORETICAL RESEARCHES IN MAGNETO-HYDRODYNAMICS. Technical (Final) Report. Øivin Holter, Eberhart Jensen, Asbjørn Kildal, Jørgen Bernhoft Knoff, and Kjell-Frode Vøyenli. June 30, 1959. 19p. Contract AF61(052)-49. (AD-219370).

A summary of research activities is presented on plasma oscillations in the classical sense, general theory of wave propagation in plasma, the form and importance of viscous forces in plasma when magnetic fields are active, plasma shock waves, and forces in a plasma conditioned by certain deviations from thermal equilibrium. (J.R.D.)

9128 AFOSR-TN-59-1312

Oslo. Universitetet. Institutt for Teoretisk Astrofysikk.

ON THE PROPAGATION OF TRANSVERSE ELECTROMAGNETIC WAVES IN A PLASMA IN A MAGNETIC FIELD. Scientific Report No. 1. Øivin Holter. 1959. 61p. Contract AF61(052)-49.

Boltzmann's equation is the basis for the most general determination of the propagation constants by statistical theory. The rather drastic simplifications necessary make the solution valid for a Lorentz gas only. By assuming a constant collision frequency we obtain the macroscopic approximation, in which a general formula for the refractive index is evaluated explicitly. The latter formula contains the Appleton-Hartree formula and Astrom's results as special cases. An investigation of the collision effect on Astrom-Ferraro waves gives the limiting velocity equal to zero as the frequency approaches zero. (auth)

9129 CARDE-TM-AB-26

RCA Victor Co., Ltd. Research Labs., Montreal.

PLASMAS AND THE ELECTROMAGNETIC FIELD. M. P. Bachynski, I. P. Shkarofsky, and T. W. Johnston. Jan. 1959. 173p. (PCC-D46-95-51-10).

A fundamental review of plasma physics with emphasis on interaction of electromagnetic waves with plasmas is given. The basic ideas of the motion of charged particles comprising a plasma gas are presented and followed by more rigorous formulations. The interactions of the atomic gas constituents are considered and their effects assessed under various conditions. Electromagnetic wave interaction is introduced through Maxwell's equations for both uniform and nonuniform plasmas. The utility and limitations of microwave measurements and techniques for determining plasma properties are discussed. (auth)

9130 CF-60-1-72
Oak Ridge National Lab., Tenn.
SOME COMMENTS ON THE IOFFE EXPERIMENT. Albert Simon. Jan. 22, 1960. 13p. Contract [W-7405-eng-26]. OTS.

A recent paper by Ioffe et al. indicates the presence of an additional energy loss mechanism (other than charge exchange) when a hot plasma is confined in a mirror geometry. It is shown that most of Ioffe's measurements fall into a very regular pattern and can be qualitatively explained by the assumption of a single monotonic relation between the unknown loss rate and the average ion energy. A discussion of some possible origins of the addition loss rate is given. None of the models seems entirely satisfactory. (auth)

9131 EDK-E14
Sylvania Electric Products Inc. Electronic Defense Lab., Mountain View, Calif.
RESONANT POWER TRANSFER WITHIN A PLASMA IN A MAGNETIC FIELD. James E. Drummond. Apr. 30, 1956. 72p. Contract DA-36-039-sc-71053. (AD-101889).

Conditions under which power can be transferred to or from a small oscillating electromagnetic field within a plasma in a static magnetic field are described. Frequencies are found for which the electric field and current are in phase and hence for which the power transfer can be large. The electromagnetic vector potential, previously neglected, is responsible for three effects: (1) a correction is found for the conductivity tensor, (2) electron current flows along the axis of the static magnetic field under the action of a purely transverse electric field, (3) a correction term proportional to the rf magnetic field appears in the "low temperature dispersion law." (auth)

9132 MATT-17
Princeton Univ., N. J. Project Matterhorn.
THE APPLICATION OF MICROWAVE TECHNIQUES TO STELLARATOR RESEARCH. Mark A. Heald. Aug. 26, 1959. 109p. Contract AT(30-1)-1238. OTS.

The basic principles of microwave diagnostics are summarized as applied to the highly-ionized, high-temperature plasmas encountered in controlled fusion devices, particularly stellarators. The first section discusses the electrical conductivity and the propagation of waves in an ionized gas. The second discusses methods of measurement of the high-frequency conductivity, with emphasis on the "free-space" optical technique appropriate for large, high-density plasmas. The third section deals with microwave radiation emitted by the plasma. (auth)

9133 NP-8342
Defense Atomic Support Agency. Field Command, Albuquerque, N. Mex.
SUMMARY OF SHERWOOD ACTIVITIES. Period [covered] August 1, 1959 to January 31, 1960. Wendell S. Winn. Feb. 1, 1960. 19p. OTS.

A brief summary of Sherwood activities at the various research facilities for the period Aug.-Jan. 1960 is presented. (W.D.M.)

9134 NP-8347
Radio Corp. of America. Astro-Electronic Products Div., Princeton, N. J.
RESEARCH ON "PLASMA ACCELERATION BY ELECTRIC FIELD GRADIENT." Monthly Progress Report [for] January 1960. Jan. 29, 1960. 4p. Project No. 4766. Contract AF49(638)-658.

Research is presented on the acceleration of a plasma by an alternating electric field with an amplitude gradient and to develop an understanding of the underlying principles of such means of acceleration, especially as may be applicable to electronic rocket propulsion. (W.L.H.)

9135 NP-8348
Radio Corp. of America. Astro-Electronic Products Div., Princeton, N. J.
RESEARCH ON PLASMA ACCELERATION BY ELECTRIC FIELD GRADIENT. Semi-annual Technical Report [for] June 30, 1959–December 31, 1959. Dec. 1959. 74p. Project No. 4766. Contract AF49(638)-658.

Theoretical and experimental studies of plasma acceleration by nonuniform r-f fields are presented. Theoretical considerations indicate that a plasma will be accelerated toward the low-field region if the applied frequency is greater than the plasma frequency and toward the high-field region if the frequency is less than the plasma frequency. Pulses of mercury plasma were generated in a reproducible way, and an r-f system was designed and operated. Phototubes and electron and ion pickup probes were used for detecting the moving plasma. Oscillograms show a change in plasma velocity as the r-f field is applied. (auth)

9136 NYO-2877
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
EXPERIMENTS ON SUPERSONIC PLASMA FLOW ALONG MAGNETIC FIELDS. [PART] II. David M. Wetstone. Sept. 30, 1959. 112p. OTS.

Time-integrated photographs are presented of collimated plasma flow parallel to magnetic fields up to 3 weber/m^2, into and out of magnetic mirrors, and along curved fields. The material projected along the field lines was substantially Cu plasma, created by short vacuum spark bursts (plasmoids), and injected into a vacuum chamber. Nonuniform solenoids expanded or compressed the plasma flow, which followed the field lines. In the case of curved fields, more complicated flows were observed, due to the presence of internal polarization fields, and the plasmoid followed the field lines only when the density (up to 3×10^{13} ions/cc) was sufficiently reduced. Photomultiplier studies were employed with some geometries to estimate center-of-mass and expansion velocities which reached 5.5 and 1.9 cm/μsec, respectively, adequately demonstrating supersonic flow. The latter figure gives an upper bound to ion temperature of 120 ev for Cu. This ion energy is considerably higher than those normally encountered in spark channels and is a substantial fraction (0.12) of the axial energy. A mechanism is described for achieving such thermal energies through the interaction of a strong shock wave with the initial discharge channel, thermalizing a large fraction of the axial energy. The upper bound for ion Larmor radius was that of the plasma flow. Estimates are presented of electron temperature and degree of ionization. A theoretical total reflection coefficient is derived for a plasmoid entering a magnetic mirror. An experimental transverse drift velocity of 5×10^4 cm/sec (in the straight solenoid) was observed and discussed. A description of the experimental equipment and electrical circuits is included. A digital machine computation method is described for obtaining field line distribution and density in a wide variety of coil geometries. (auth)

9137 PPL-122
Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N. Y.
EXPERIMENTAL INVESTIGATIONS OF ELECTROMAGNETICALLY INDUCED DETONATIONS. PART I. PARAMETERS AFFECTING THE FORMATION OF THE PINCH. Thomas Donner and Leonard Aronowitz. Nov. 1959. 35p. Contract AF49(638)-552. (AFOSR-TN-60-59).

Tests were conducted with various gases to investigate

the conditions needed for the formation of the "pinch discharge." Most tests were conducted at capacitor energies somewhat below those under which pinch had been previously obtained. Tests were made with mixtures of H_2 and O_2 in an attempt to obtain pinch induced detonations. The results indicate that pressure, the type of gas, and the energy in the capacitors discharged through the gas, affect the type of discharge. The various types of discharges that were obtained were classified according to their appearance on streak photographs. It was not established whether pinch induced detonations were obtained with the combustible mixtures tested. (auth)

9138 AEC-tr-3984

ON THE MECHANISM OF HIGH-FREQUENCY DISCHARGE. H. Beck. Translated by Lydia Venters (Argonne National Lab.) from Z. physik 97, 355-75(1935). 18p. JCL.

To clarify the high-frequency discharge mechanism, optical and electric measurements were set up. It is shown that there is no difference in the intensity between the high-frequency and direct-current positive column. The absorption measurements produce the same number of excited states in the high-frequency discharge as well as in the positive direct current column. It is shown that stepwise excitation cannot be used for explaining the burning voltage of the high-frequency discharge. Probe measurement data is compared to the experiments of Banerji and Ganguli, who have used the Langmuir probe for the high-frequency discharge. Data is provided only for the electron temperature. The electron temperatures in the high-frequency discharge agree with those of the positive column. The experimental data can be used to explain the discharge mechanism of the high-frequency discharge in a manner analogous to that of the positive column. (auth)

9139

ON THE SIMILARITY RULE IN MAGNETO-GAS-DYNAMICS. M. Z. v. Krzywoblocki and J. Nutant (Univ. of Illinois, Urbana). Acta Phys. Austriaca 13, 1-18(1960) Jan. (In English)

The case of a diabatic flow (a flow of an inviscid, non-heat conducting fluid with heat addition by means of sources) in an electro-magnetic field is considered. The two-dimensional equations of the velocity potential and of the stream-function are transformed into the hodograph plane. Assuming a simplified pressure-density relation, a similarity rule is derived for flow and is applied to the case of a dimensionless compressible flow. The rule is also used to establish a correspondence between compressible and incompressible flow. (auth)

9140

ELECTRON TEMPERATURE IN ELECTRODELESS DISCHARGE SUBJECTED TO A TRANSVERSE MAGNETIC FIELD. S. N. Goswami (Calcutta Univ.). Indian J. Phys. 33, 452-5(1959) Oct.

Values of electron temperature in molecular gases subjected to electrodeless discharge were obtained from electronic mobility and its variation with pressure. Discrepancy of the results with the data of other authors is shown for the effect of the magnetic field and the high value of X/p. (auth)

9141

THE TIME-DEPENDENT MAGNETOHYDRODYNAMIC FLOW PAST A FLAT PLATE. G. F. Carrier and H. P. Greenspan (Harvard Univ., Cambridge, Mass.). J. Fluid Mech. 7, 22-32(1960) Jan.

Two time-dependent magnetohydrodynamic flow problems are discussed. The situation is considered in which a semi-infinite flat plate is moved impulsively in its own plane into an electrically conducting viscous fluid. The ambient magnetic field has the same direction as the motion of the plate; it is found that when $\mu H_0^2/\rho U_0^2 < 1$, the flow pattern approaches asymptotically the steady flow found earlier (Greenspan & Carrier 1959). When $\mu H_0^2/\rho U_0^2 > 1$, the asymptotic state is one in which the fluid accompanies the plate in a rigid body motion as was anticipated in the earlier work. The case is also considered in which an infinite plate is moved impulsively in its own plane in the presence of an ambient magnetic field which is perpendicular to the plane of the plate. It is shown that the problem is not uniquely set until one specifies what three-dimensional problem reduces in the limit to the two-dimensional problem so defined. The answers in the conceptually acceptable limit case investigated here (the plate being a pipe of very large radius) have an asymmetry which at first sight is unexpected. (auth)

9142

STEADY FINITE MOTIONS OF A CONDUCTING LIQUID. Robert R. Long (The Johns Hopkins Univ., Baltimore). J. Fluid Mech. 7, 108-14(1960) Jan.

In certain cases of steady motion of a conducting fluid in a magnetic field, the primitive equations may be integrated once, yielding a second-order partial differential equation in the stream function. This equation is highly non-linear in general, but for certain choices of basic flow and magnetic fields it is tractable. Several arbitrary functions of integration have to be evaluated to make the analysis useful. This may be done in a region that remains undisturbed. A short discussion is given to suggest a procedure for deciding in a special case whether this undisturbed region is 'upstream' or 'downstream'. (auth)

9143

TEST PARTICLES IN A COMPLETELY IONIZED PLASMA. Norman Rostoker and M. N. Rosenbluth (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Fluids 3, 1-14(1960) Jan.-Feb.

Starting from the Liouville equation, a chain of equations is obtained by integrating out the coordinates of all but one, two, etc., particles. One "test" particle is singled out initially. All other "field" particles are assumed to be initially in thermal equilibrium. In the absence of external fields, the chain of equations is solved by expanding in terms of the parameter $g = 1/nL_D^3$. For the time evolution of the distribution function of the test particle, an equation is obtained whose asymptotic form is of the usual Fokker-Planck type. It is characterized by a frictional-drag force that decelerates the particle, and a fluctuation tensor that produces acceleration and diffusion in velocity space. The expressions for these quantities contain contributions from Coulomb collisions and the emission and absorption of plasma waves. By consideration of a Maxwell distribution of test particles, the total plasma-wave emission is determined. It is related to Landau's damping by Kirchoff's law. When there is a constant external magnetic field, the problem is characterized by the parameter g, and also the parameter $\lambda = \omega_c/\omega_p$. The calculation is made by expanding in terms of g, but all orders of λ are retained. To the lowest order in g, the frictional drag and fluctuation tensor are slowly varying functions of λ. When $\lambda \ll 1$, the modification of the collisional-drag force due to the magnetic field, is negligible. There is a significant change in the properties of plasma waves of wavelength greater than the Larmor radius which modifies the force due to plasma-wave emission. When $\lambda \gg 1$, the force due to plasma-wave emission disappears. The collisional force is altered to the extent that the maximum impact parameter is sometimes the Larmor radius instead of the Debye length, or

something in between. In the case of a slow ion moving perpendicular to the field, the collisional force is of a qualitatively different form. In addition to the drag force antiparallel to the velocity of the particle, there is a collisional force antiparallel to the Lorentz force. The force arises because the particle and its shield cloud are spiralling about field lines. The force on the particle is equal and opposite to the centripetal force acting on the "shield cloud." It is much smaller than the Lorentz force. (auth)

9144

ABSORPTION OF PLASMA WAVES. Thomas H. Stix (Princeton Univ., N. J.). Phys. Fluids 3, 19-32(1960) Jan.-Feb.

The propagation of waves through a plasma, wherein the density and/or magnetic field strength are slowly varying functions of position is discussed. If the local propagation constant, k_x, is a slowly varying function of x, the adiabatic approximation will be valid. However, k_x^2 may pass through zero as a function of x. Using the WKB linear turning point connection formulas, examination shows that an incoming plasma wave is totally reflected in the region where $k_x^2 \approx 0$. A similar analysis for the case where k_x^2 is a singular function of x shows that absorption of an incoming wave occurs in the vicinity of the singularity. Such singular behavior in k_x^2 can occur for propagation along the magnetic field when the wave frequency is equal to the local ion or electron cyclotron frequency. For propagation transverse to the magnetic field, an apparent singularity occurs at a frequency somewhat below the ion cyclotron frequency, and at the two hybrid frequencies of Auer, Hurwitz, and Miller. A detailed examination, including higher order effects in electron mass + ion mass, finite electron and ion temperatures, and ion-ion and ion-electron collisions shows that the absorption will take place at the apparent singularity only if the physical damping processes are strong enough to swamp the reactive effects of the higher order corrections. Otherwise the higher order reactive effects introduce a new propagation mode into the dispersion equation with a root which, in the vicinity of the apparent singularity, is conjugate to the root of the original mode. Partial or total reflection now occurs at the apparent singularity instead of absorption. It is, however, conjectured that some of the original mode energy may be reflected into the new mode. As the new mode recedes from the region of the apparent singularity, its wavelength can become comparable to the particle Larmor radius. Energy in this mode may then be absorbed by phase-mixing processes which are of high order in the quantity (Larmor radius + wavelength). Wave reflection from the apparent singularities will then heat ions in the case of the transverse ion cyclotron mode, and electrons in the case of the upper hybrid frequency. (auth)

9145

TRANSVERSE COMPRESSION WAVES IN A STABILIZED DISCHARGE. Daryl Reagan (Oxford Univ.). Phys. Fluids 3, 33-9(1960) Jan.-Feb.

An electric discharge which is compressed by its own magnetic field, and "stabilized" by means of an axial magnetic field, can have transverse wave motions which cause its periodic compression and expansion. This kind of motion can cause the heating of the ions in the discharge. The simplest of these wave modes are described and an estimate is given of the power available to the waves as a result of the interaction of the electrons in the discharge with an axial electric field. This interaction can cause the attenuation or spontaneous growth of the waves, depending upon the circumstances. It is likely that in high current gas discharge experiments there are examples of growing and decaying waves of this type. (auth)

9146

INSTABILITY OF CONTRA-STREAMING PLASMAS. Paul J. Kellogg and Harold Liemohn (Univ. of Minnesota, Minneapolis). Phys. Fluids 3, 40-4(1960) Jan.-Feb.

The problem of instabilities in colliding ionized hydrogen beams, which was treated by Kahn and Parker in the special case of zero temperature, is solved for the nonzero temperature case by taking Maxwell distributions for the equilibrium density functions. At sufficiently high temperature it was found that the random thermal motion prevents growing oscillations. The boundary between the stable and unstable regions is plotted as a function of energy and density parameters. Certain phenomena associated with solar particle streams are discussed in terms of these results. (auth)

9147

CYCLOTRON RADIATION FROM A HOT PLASMA. W. E. Drummond and M. N. Rosenbluth (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Fluids 3, 45-51(1960) Jan.-Feb.

Trubnikov and Kudryavtsev calculated the cyclotron radiation from a hot plasma. The assumption was made that the individual particles radiated as though they were in a vacuum. This approximation was investigated by calculating the absorption length directly from the Boltzmann equation, and it was found that this assumption is correct whenever $(\omega_p/\omega_e)^2 \ll m^2$, where m is the harmonic number of the radiation in question, ω_p is the plasma frequency, and ω_e is the cyclotron frequency. For a contained plasma, the left hand side of this inequality is of the order of magnitude of one, and thus the inequality is well satisfied for the dominant radiation from a plasma at high temperature. The angular independence of the absorption coefficient was calculated, and this together with a more careful examination of the mechanism of thermonuclear energy transfer to the electrons, leads to a modification of the results presented by Trubnikov and Kudryavtsev. In addition, it is shown that by the use of reflectors the critical size can be reduced by two orders of magnitude. (auth)

9148

IRREVERSIBLE PROCESSES IN IONIZED GASES. R. Balescu (Université Libre, Brussels). Phys. Fluids 3, 52-63(1960) Jan.-Feb.

The general theory of irreversible processes, developed by Prigogine and Balescu, is applied to the case of long range interactions in ionized gases. A similar diagram technique permits the systematic selection of all the contributions to the evolution of the distribution function, to an order of approximation equivalent to Debye's equilibrium theory. The infinite series which appear in this way can be summed exactly. The resulting evolution equations have a clear physical significance: they describe interactions of "quasi particles," which are electrons or ions "dressed" by their polarization clouds. These clouds are not a permanent feature, as in equilibrium theory, but have a nonequilibrium, changing shape, distorted by the motions of the particles. From the mathematical point of view, these equations exhibit a new type of nonlinearity, which is very directly related to the collective nature of the interactions. (auth)

9149

HEAT TRANSPORT BY CONVECTION. Yoshinari Nakagawa (Univ. of Chicago). Phys. Fluids 3, 82-6(1960) Jan.-Feb.

The character of heat transport by cellular convection, which arises beyond the marginal state of stability in a layer of fluid bound between two constant temperature surfaces is examined. It is shown that a simple equation characterizes the heat transport in the neighborhood of the marginal state of stability when the convection is steady, and its cellular pattern of motion is represented by the solutions of the linear theory. The results of the study include all three cases of boundary conditions, namely, when the bounding surfaces of the layer are both free, are both rigid, or one is free and the other is rigid. (auth)

9150

HEAT TRANSPORT BY CONVECTION IN PRESENCE OF AN IMPRESSED MAGNETIC FIELD. Yoshinari Nakagawa (Univ. of Chicago). Phys. Fluids 3, 87-93(1960) Jan.-Feb.

The effect of an impressed magnetic field on heat transport by convection, which arises from instability in a layer of an electrically conducting fluid, bounded between two constant temperature surfaces, is examined. It is shown that such a field reduces the amount of heat transported by convection, and that when the strength of the magnetic field is increased, such reduction becomes proportional to $(\pi^2 Q)^{-1}$, where $Q = \sigma\mu^2 \cos^2\theta H^2 d^2/\rho\nu$, d is the depth of the layer, ρ the density, H the strength of magnetic field, θ the inclination of the direction of H to the vertical, and σ, μ, and ν are the coefficients of electrical conductivity, magnetic permeability, and kinematic viscosity, respectively, for all types of the boundary conditions. It is also shown that in the neighborhood of the marginal state of stability, a simple formula characterizes the heat transport by convection. (auth)

9151

STEADY STATE SOLUTIONS IN THE RADIOFREQUENCY DISCHARGE WITH FLOW. Mary F. Romig (Convair Scientific Research Lab., San Diego, Calif.). Phys. Fluids 3, 129-33(1960) Jan.-Feb.

The electron density distribution and diffusion length were investigated for a steady-state, diffusion-controlled radiofrequency discharge acting over a finite portion of an infinite cylinder in which there is a uniform axial gas flow. This model simulates to some extent the flow in a plasma wind tunnel. A qualitative relationship is obtained for the influence of active cylinder length and gas velocity parameter on the diffusion length. The effect of these parameters on the electric field necessary to sustain the discharge is discussed. It is shown that the peak of the electron density distribution shifts downstream with increasing gas velocity, but never leaves the region of production. A numerical example is calculated for the case of helium, indicating that while there is moderate effect on breakdown parameters, the ambipolar case may be changed considerably by the presence of flow. (auth)

9152

PERFORMANCE OF A HYDROMAGNETIC PLASMA GUN. John Marshall (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 3, 134-5(1960) Jan.-Feb.

The performance of a hydromagnetic plasma gun is discussed which is able to accelerate several liters of hydrogen plasma containing about 5×10^{13} protons to a velocity of 1.5×10^7 cm/sec and deposits more than 40% of the electric input energy at its terminals into kinetic energy of the jet. Magnetic probe measurements indicate that the jet can punch its way axially through the 10,000-gauss field of an external solenoid. Mass spectroscopic observations of a collimated sample of the jet shows a proton velocity spread of less than a factor of two. This and other evidence indicates a relatively low temperature of the plasma compared to its kinetic energy (100 ev per proton). (B.O.G.)

9153

ION WAVE INSTABILITIES. Ira B. Bernstein, Edward A. Frieman, and Russell M. Kulsrud (Princeton Univ., N. J.) and Marshall N. Rosenbluth (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Fluids 3, 136-7(1960) Jan.-Feb.

Recent experimental evidence indicated the existence of a rapid particle loss which was attributed to an enhanced diffusion across the magnetic field. The existence of a low-frequency ion wave instability is pointed out, which can give rise to excitation of ion waves above thermal equilibrium levels. Within the designated limits, the dispersion relation for propagation at an angle to the magnetic field is essentially the same as that for propagation along the magnetic field. Parallel propagation was investigated where general results obtained were independent of the exact form of the equilibrium distribution functions. When both the ion and electron temperatures are finite, instabilities may be found which have propagation vectors at some angle to the magnetic field and for which a critical current must be exceeded for the onset of instability. (B.O.G.)

9154

FLOW OF A PARTIALLY IONIZED GAS IN AN AXIAL MAGNETIC FIELD. P. J. Dickerman and C. F. Price (Univ. of Chicago). Phys. Fluids 3, 137-8(1960) Jan.-Feb.

The influence of an axial field on the flow properties and heat transfer characteristics of an ionized gas in a cylindrical flow channel was investigated. Arc parameters and spectroscopy, along with velocity measurements, were used to establish initial flow conditions. From energy balance considerations plus electron continuum and atomic iron line spectroscopic measurements, radial and axial plasma temperature profiles were established. The axial temperature is 7000°K at the magnet entrance when the arc power is 1 Mw. The plasma pressure is atmospheric with densities in the region 10^{17} to 10^{18} particles per cm^3, such that thermal equilibrium is approached. A flux reduction of the order of 19% for a 20-kilogauss field is shown. This is theoretically quite satisfactory since the plasma temperature corresponds roughly to an electrical conductivity of 10^{-8} emu or less. Attempts were made to "seed" the plasma flow with an easily ionizable element to increase electrical conductivity and magnetic interaction. No significant advantage was obtained, since the increased radiation offsets any magnetohydrodynamic benefits. Further investigations are being made to firmly establish flow properties and more effective means of introducing a seeding material. (B.O.G.)

9155

COMMENTS ON "EXPERIMENTAL DEMONSTRATION OF HYDROMAGNETIC WAVES IN AN IONIZED GAS." John M. Wilcox and Forrest I. Boley (Univ. of California, Berkeley). Phys. Fluids 3, 141-2(1960) Jan.-Feb.

Comments are presented on the report of Sawyer, Scott, and Stratton concerning attenuation of hydromagnetic waves in a deuterium discharge plasma. The Newcomb equation $\epsilon = c^2(k_c^2 + k^2)/8\pi\sigma V$ gives an attenuation factor $\epsilon = 1.2$ cm^{-1} for the case investigated by Sawyer et al. Thus the wave amplitude is expected to drop 1/e in less than 1 cm. (B.O.G.)

9156

INCOHERENT MICROWAVE RADIATION FROM PLASMAS. G. Bekefi, Jay L. Hirshfield, and Sanborn C. Brown (Mas-

sachusetts Inst. of Tech., Cambridge). Phys. Rev. 116, 1051-6(1959) Dec. 1.

A study is made of the incoherent radiation from an isotropic, quiescent plasma of a low degree of ionization. Three cases are treated theoretically: the transparent plasma, the semiopaque plasma, and the opaque plasma. Radiation from positive columns of d-c glow discharges in helium and hydrogen for the three cases treated theoretically are studied experimentally at 3000 Mc/sec, and good agreement is obtained between theory and experiment. (auth)

9157

FORMATION OF POSITRONIUM IN AN ELECTRON GAS. Joseph Callaway (Univ. of London). Phys. Rev. 116, 1140 (1959) Dec. 1.

It is shown to be unlikely that a positronium atom, described by a hydrogenic wave function, can exist in an electron gas of a density corresponding to that found in metals. (auth)

9158

LINEARIZED THEORY OF PLASMA OSCILLATIONS. L. Oster (Yale Univ., New Haven). Revs. Modern Phys. 32, 141-68(1960) Jan.

The basic hydrodynamic and Maxwellian equations found in the linearized theory of plasma oscillations are derived. An attempt is made to elucidate the relations between different approaches for investigating linearized theory. The possible basic modes of plasma oscillations are discussed. Longitudinal oscillations are discussed. Longitudinal oscillations and the variation of pressure accompanying the longitudinal waves are considered. The influence of the introduction of damping terms in the equation of motion is discussed. The treatment of plasmas with nonzero magnetic fields is discussed relative to motions perpendicular to the propagation direction of longitudinal waves and the case of transverse waves and motions parallel and perpendicular to their direction of propagation. The relation between Alfvén's magnetohydrodynamics and linearized theory of plasma oscillations was established. A kinetic theory treatment of plasma oscillations is given to show what restrictions on the shape of the velocity distribution of electrons are necessary for the hydrodynamic treatment to be valid. The cases treated by kinetic theory include: the distribution function in longitudinal oscillations, velocity distributions for transverse oscillations, and oscillations with a constant magnetic field. (C.J.G.)

Shielding Calculations

9159 AN-108

Associated Nucleonics, Inc., Garden City, N. Y.

DOSE ATTENUATION BY SOILS AND CONCRETE FOR BROAD, PARALLEL-BEAM NEUTRON SOURCES. David Spielberg and Arthur Duneer. May 1, 1958. 166p. Contract NBy-13028. OTS.

The theory and results of certain neutron shielding studies performed to supply information primarily for underground bomb shelter design are presented. Specifically, for neutron source energies of 0.025 ev, 0.5, 2.5, 7.5, 10, and 14 Mev, and various angles of incidence upon the ground, results are presented that show the total neutron plus secondary gamma dose rates which would be received by individuals located in shelters at various distances below ground. To cover the entire range of possibilities, four basically different soil types were analyzed with water contents ranging from zero to saturation. This range also includes concrete. Also, dose rates were calculated for depths ranging from 30 to 1,000 grams/cm^2. The information presented is considered to be engineering-type data of sufficient accuracy for the intended use. The multi-group theory which was utilized has obvious deficiencies in that certain nuclear scattering characteristics are simplified or ignored. Therefore, the results should not be construed as scientific-type data where comparison with experiment can result in gaining some insight regarding the primary nuclear scattering processes. (auth)

9160 CRP-860

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE ATTENUATION OF NEUTRONS BY THE SIDE SHIELD OF THE NRU REACTOR. J. M. Robson. Oct. 1959. 25p. (AECL-932). AECL.

Results of measurements of the thermal, epithermal, and fast neutron fluxes at various locations in the side shield of the NRU reactor are presented. Mean free paths for those neutrons whose energy exceeds 2 Mev are found to be 8.3, 5.5, and 13.4 cm in light water, steel, and ilmenite concrete, respectively. (auth)

9161

METHODS FOR COMPUTING THE THICKNESS OF SHIELDS AGAINST GAMMA-RAYS. László Tihanyi (Highway and Railroad Planning Enterprise, [Budapest]). Energia és Atomtech. 12, 7-12(1959) Jan. (In Hungarian)

A graphical method for computing the lead shield thickness to be used with 25 gamma-active isotopes is presented. The equivalent thicknesses for iron, concrete, aluminum, or water shields are given. Shortcomings of the method are discussed. (C.J.G.)

Theoretical Physics

9162 NP-8358

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

ON ALLOWED BETA TRANSITIONS. [PART] I. Report No. 116/VII. B. Kuchowicz. Nov. 1959. 10p.

Formulas for allowed beta transitions are presented. Spectrum shapes, $e-\nu$ angular correlation, and electron polarization were obtained for the universal Fermi interaction. Second forbidden relativistic terms were included in the formulas. (auth)

9163

CONTRIBUTION TO THE THEORY OF BOSONS AND FERMIONS WITH ORIENTED SPINS. A. A. Sokolov and Yu. M. Loskutov (Moscow State Univ.). Ann. Physik (7) 5, 42-52(1959). (In English)

A theory is developed for positive and negative energy charged bosons and fermions with spins directed oppositely with respect to the corresponding momenta. Invariance of the equations for a fixed spin direction is investigated. (auth)

9164

INTERACTIONS OF FIELDS IN INVERSION IMAGES. Kuo-Hsien Tzou. Compt. rend. 250, 668-70(1960) Jan. 25. (In French)

A suggestion is offered of some interactions of localized fields on different coördinates which are images of each other with respect to certain inversions, especially CPT and M. The deduction of the particular V−A form of universal interactions of four fermions is shown. (tr-auth)

9165

LOCAL CONSERVATION LAWS IN GENERALLY COVARI-

ANT THEORIES. John George Fletcher (Princeton Univ., N. J.). Revs. Modern Phys. 32, 65-87(1960) Jan.

The covariant theories discussed employ a d-dimensional, locally Euclidean, topological space and the field variables χ^A. A description is given of the basic facts about the theories under discussion and the Lagrange formalism employed is reviewed. The forms of local conservation laws are described and the contrasts between strong and weak laws are noted. Covariant properties of conservation laws are discussed. The idea of symmetry operations of a Lagrangian are discussed, and the infinitesimal coördinate and similarity transformation operations are reviewed. By the use of examples it is shown how conservation laws may be derived from a knowledge of the infinitesimal symmetry operations of the Lagrangian. The converse problem of whether all conservation laws follow from symmetries of the Lagrangian is discussed. The commutator method of obtaining conservation laws is described. A proof is given of Noether's theorem which states that all the conservation laws characteristic of generally covariant theories are strong laws. The relations between the various conservation laws in generally covariant theories are discussed. The limitations upon the usefulness of the values of conserved quantities as first integrals of the equations of motion and as definitions of experimental quantities are demonstrated. The conservation laws suitable as indicators of the Schwarzchild mass are indicated. The mathematical uses of conservation laws, including their uses in relation to the Hamiltonian and problem of motion, are considered. The mathematical uses of conservation laws in finding the source terms of the gravitational field, in showing a connection between gauges and constraints, and in the Schwinger formalism for quantum mechanics are described. (C.J.G.)

REACTOR TECHNOLOGY

General and Miscellaneous

9166 ANL-6115

Argonne National Lab., Lemont, Ill.

POST CRITICALITY STUDIES ON THE TREAT REACTOR. Haig P. Iskenderian. Feb. 1960. 13p. Contract W-31-109-eng-38. OTS.

Criticality calculations for the TREAT reactor, assuming no slots and no test hole, and using a modified Fermi-Age Theory which allows for epithermal absorption and fission, indicated a critical radius of 59 cm. At the time of startup TREAT became critical at a radius of 67.8 cm. The results of spectrochemical and chemical tests indicated a high boron impurity (an average of 7.6 ppm) in the core graphite, and a maximum of about 1.8 wt.% H_2O in one sample from the permanent reflector graphite. The excess amount of boron impurity in the core graphite appears to be the major cause of the discrepancy. Values of the negative temperature coefficient of reactivity and of neutron lifetime were calculated for the critical reactor containing 7.6 ppm of boron, assuming no slots or test holes, and the results are found to be in fair agreement with measurements. The source of excess boron impurity was traced to the borated steel separators which were used during the baking of the fuel elements. (auth)

9167 CF-60-1-100

Oak Ridge National Lab., Tenn.

2G-2R SPHERICAL REACTOR CODE FOR THE IBM-704. T. B. Fowler. Jan. 26, 1960. 19p. OTS.

A code, based on the analytical solution of a spherical, two-group, two-region reactor problem, was written for the IBM-704. Both the core and blanket can handle two fuel components, moderator, fertile material (Th^{232} or U^{238}), poison, and 5 additional components. Each of the core component concentrations may be specified either as a ratio of the critical fuel concentration or as a constant value. Fast fissions may be accounted for and the adjoint fluxes may be computed if desired as well as the temperature coefficient of reactivity. Provisions were made for computing the multiplication constant for reactors with specified core fuel concentrations. (auth)

9168 CF-60-2-34

Oak Ridge National Lab., Tenn.

A STUDY OF THE FUEL VALUE OF PLUTONIUM. S. Jaye, L. L. Bennett, and M. P. Lietzke. Feb. 11, 1960. 90p. OTS.

The fuel value of mixtures of plutonium isotopes has been calculated for five thermal reactors (Yankee, Dresden, Hallam, GCR-II, Carolinas-Virginia). Plutonium with very high Pu^{239} content may be utilized economically in any of the reactors; its value varies from $8.1 to $16.5 per gram depending on the reactor. The use of once-recycle plutonium mixed with natural uranium is economical only in reactors with good neutron economy. The value of twice-recycle plutonium mixed with natural uranium was less than $5 per gram in four of the five reactor types studied. Fuel-cost calculations indicate that future reductions in fuel fabrication and handling charges will reduce fuel costs less than 1 mill/Ekwh if the annual fuel inventory charges are increased from 4 to 8%. The calculated fuel values for plutonium were not significantly affected by the use of projected-cost rather than present-cost estimates. (auth)

9169 DP-452

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

MODERATOR TEMPERATURE COEFFICIENTS IN HEAVY WATER REACTORS. Daniel S. St. John. Dec. 1959. 7p. Contract AT(07-2)-1. OTS.

Reactors that are moderated with heavy water differ from those that are moderated with graphite in that (1) the moderator temperature is lower than it may be in graphite reactors, (2) when the moderator temperature is raised, the moderator-to-fuel ratio decreases, and (3) circulation in the moderator introduces local, random changes in reactivity that distort the flux distribution. The large negative contributions to the moderator temperature coefficient from leakage and resonance capture overshadow any positive contribution from eta that may accompany the buildup of plutonium with exposure. The effect of the coefficient on reactor safety depends upon the manner in which the D_2O circulation couples the reactor power to the moderator temperature. (auth)

9170 HW-63183

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STEADY-STATE RECIRCULATING REACTOR STABILITY AND OPERATIONAL CHARACTERISTICS—WATER AND METAL TEMPERATURE COEFFICIENTS. C. Wesley Allen. Dec. 23, 1959. 26p. Contract AT(45-1)-1350. OTS.

Limits on the water and metal temperature coefficients are derived to assure stable operation in any recirculating reactor system in which the metal and coolant temperature govern the prompt reactivity feed-back. Within the region of stable operation, relationships between inlet temperature, outlet temperature, reactor power, steam tempera-

ture, and exterior reactivity control are derived. For all cases a positive metal temperature coefficient with a positive water temperature coefficient results in unstable operation. When both coefficients are negative, stable operation always results. In the region where the two coefficients differ in sign, the results may be either stable or unstable and analysis must be made to assure stability. (C.J.G.)

9171 KAPL-M-NPA-2

Knolls Atomic Power Lab., Schenectady, N. Y.

FACTORS USED IN THE CALCULATION OF GAMMA SOURCES IN THE CORE AND PRIMARY SHIELD OF THE NCR. Melvin J. Leibson. Dec. 15, 1959. 38p. OTS.

Equations and data for calculating the gamma source strength in various material components in the reactor core and primary shield in the natural circulating Reactor (NCR) are contained. Flux factors F (thermal flux factor) and G (fast flux factor) for gamma sources were determined and used to determine the volumetric gamma sources in both core and shield. (C.J.G.)

9172 KAPL-M-NPA-4

Knolls Atomic Power Lab., Schenectady, N. Y.

JET PUMP TEST FOR NCR APPLICATION. M. Nazar and R. Eisenstadt. Jan. 29, 1960. 63p. Contract W-31-109-Eng-52. OTS.

A jet nozzle, which employs the principle of utilizing the momentum of a high-velocity stream to accelerate a low-velocity stream, was demonstrated to be a practical standby accessory to a natural convection reactor plant. Experimental results are included in the form of jet pump performance characteristics such as flow, area, and pressure ratio and efficiencies. A theoretical analysis of jet pump performance came within 3% on a 15% base in predicting the maximum efficiencies determined from experimental results. Test results show that an average of 5 pipe diameters are required to complete the process of mixing two streams of different velocities for single jet nozzles as compared to 2 pipe diameters for multi-jet nozzles. From the standpoint of efficiencies, multi-jet nozzles have possibilities but require further investigation. Obstruction in the form of pipe bends decrease jet efficiencies significantly. Reverse flow did not occur even under conditions of high resistance to flow beyond the jet nozzle. (auth)

9173 LAMS-2346 and App. I and II.

Los Alamos Scientific Lab., N. Mex.

THE DSN AND TDC NEUTRON TRANSPORT CODES. B. Carlson, C. Lee, and J. Worlton. 34p. Appendix I: THE DSN CODE. 48p. Appendix II: THE TDC CODE. 46p. Contract W-7405-eng-36. OTS.

Two reactor codes are described, one for one-dimensional geometries (DSN), and the other for the finite cylindrical case (TDC). The codes are based on a modified S_n-approach to the numerical solution of the neutron transport equation. The codes are written in Floco II for use in the IBM-704. The actual machine codes are presented in appendices I and II. (C.J.G.)

9174 ORNL-2901

Oak Ridge National Lab., Tenn.

STUDIES OF THE SPHERICAL HARMONICS METHOD IN NEUTRON TRANSPORT THEORY. IV. COMPLETION OF THE ANALYSIS OF THE LIMIT-PROCESS $L \to \infty$ FOR THE MILNE PROBLEM WITH ANISOTROPIC SCATTERING AND ABSORPTION. PLANNING OF THE NUMERICAL CALCULATIONS. Walter Kofink. Feb. 24, 1960. 44p. Contract W-7405-eng-26. OTS.

Using spherical harmonics or Gauss quadrature approximations, expressions in the limit-process $L \to \infty$ for the Milne problem were derived for the distance Δ of the extrapolated endpoint; for the linear extrapolation distance δ; for the normalization constants N, $\rho(0)$, and $j(0)$; and for the angular distribution of the emerging neutrons at the boundary of the medium. Expressions are given for the current density $j(\zeta)$ and for the density $\rho(\zeta)$ of the neutrons at an arbitrary point ζ in the interior of the medium. All expressions are calculated for anisotropic scattering with a positive or a negative constant of anisotropy $a = 3\gamma_1$ $(1-\gamma_1)$ for preferred forward or preferred backward, respectively, and for prevailing absorption, $\gamma_1 > 0$ $(c < 1)$. The case of no absorption $c = 1$ is treated. All of the above mentioned quantities are represented by eight different integrals which contain a common weight function W(u) as a factor in their integrands. This factor is singular at the upper end $u = 1$ of the integration. Two methods of removing the singularity from the process of integration by an electronic computer are given. (C.J.G.)

9175 SPM-522

[France. Commissariat à l'Énergie Atomique, Paris].

FORMULATION GENERALE DU COEFFICIENT DE DIFFUSION DANS UN MILIEU HETEROGENE COMPORTANT EVENTUELLEMENT DES CAVITES. (General Formulation of the Diffusion Coefficient in a Heterogeneous Medium Allowing Cavities). P. Benoist. Dec. 2, 1958. 105p.

An expression for the coefficient of diffusion in heterogeneous media is established starting with calculations of the time of flight in a reactor zone using a minimum of approximations. This expression is then used for the free path. Equations are set up to a classical lattice composed of a moderator, a cylindrical annular cavity, and a solid fuel rod. Corrections due to angular correlations are applied, and corrections dependent on the laplacian are studied. Finally, applications of the method are discussed. (T.R.H.)

9176 WAPD-SC-630

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

SUMMARY REPORT OF REACTOR HAZARDS ASSOCIATED WITH THE HIGH TEMPERATURE TEST FACILITY. W. A. Vogele, E. L. Humez, J. G. Wilhite, and D. S. Jones. Aug. 1959. 57p. Contract AT-11-1-GEN-14. OTS.

The title "High Temperature Test Facility" (HTTF) is the designation for the low-power pressurized water critical facility under construction at the Bettis site. A description of the Facility is presented with an analysis of the accident potential of the system and a description of the first fuel type with an evaluation of the risk associated with the operation of core assemblies utilizing this type fuel. A delineation is maintained between the Facility characteristics applicable to all experiments and the specific characteristics of the first fuel type. (W.L.H.)

9177

INFLUENCE OF TEMPERATURE ON REACTOR DYNAMICS. [PART] II. G. Kourim. Atomwirtschaft 5, 22-7 (1960) Jan. (In German)

The reactor temperature influences the chain reaction mainly through density changes consequent upon thermal expansion and through changes in the relative velocities of neutrons and atomic nuclei. This becomes evident in the differing course of the temperature dependence of the fission and capture cross-sections of the various reactor and fuel materials. The almost always non-linear relation between temperature and reactivity is described for a few completed installations. The variation with time of the temperature and the influence of temperature on reactor performance are investigated with the aid of a thermal

flow diagram for which an electrical circuit diagram was substituted in order to simplify the equations. (auth)

9178

CALCULATION OF EIGENVALUE FOR CUBIC REACTOR BY THREE GROUP DIFFUSION THEORY. Y. Fukai, S. Iijima, S. Miyamoto, and K. Monta (Nippon Atomic Ind. Group Co., Ltd.). J. Atomic Energy Soc. Japan 1, 412-18 (1959). (In Japanese)

In the calculation of the nuclear properties of a cubic reactor, rectangular parallelepiped core with a multi-reflector, the IBM-650 is generally unsuitable for difference equations by few group diffusion theory. If a determinant method is used, the critical equations of the cubic reactor derived from three group diffusion theory can be numerically calculated by IBM-650. Assuming separability of neutron flux into three components which are functions of x, y, and z respectively, three determinants, $|x|$, $|y|$, and $|z|$, are derived from boundary conditions for neutron flux and current. Therefore the critical conditions are $|x| = 0$, $|y| = 0$, and $|z| = 0$, where these three determinants are function of three eigenvalues; μ_x, μ_z, and μ_y. The IBM-650 CUBE code for this theme is presented, and a procedure for simultaneous convergence of three determinant to zero is given. Since the convergence is very rapid, CUBE is useful for parameter surveys of the nuclear properties of a cubic reactor, though there are some restrictive conditions for nuclear constants and reactor size. (auth)

9179

REACTOR PHYSICS EXPERIMENTS USING SUBCRITICAL SYSTEMS. A. Ōyama and S. An (Univ. of Tokyo). J. Atomic Energy Soc. Japan 1, 436-46(1959). (In Japanese)

A review is presented on reactor physics experiments using subcritical systems. Experimental facilities and techniques are described, and the correlations of theory and experiments are discussed. Some of the interesting pulsed neutron experiments utilizing subcritical systems are also discussed. (auth)

9180

RADIOLYTIC DECOMPOSITION ANALYSIS. THE HARWELL EXPERIMENTS. Nuclear Eng. 5, 59-61(1960) Feb.

Investigations were made at Harwell on the limitations which exist in an organic moderator and of the pyrolytic and radiolytic decomposition of various organic liquids including Santowax-R. Breakdown appears to be essentially a function of the G-values of the linear energy transfer of the disruptive agency. The G-values are not the same for heavy particles (and consequently neutrons, which produce knocked-on carbon and hydrogen ions in the hydrocarbon), gamma rays, and electrons. Additional information is required concerning radiolytic decomposition, particularly at high HB content, but the Harwell interpretation of existing data does bring a large measure of consistency into what would otherwise be a mass of discrepant information. (B.O.G.)

9181

ORGANIC MAKE-UP DATA. AN ENGLISH ELECTRIC EVALUATION. J. Scrivins (The English Electric Co., Ltd., Whetstone, Eng.). Nuclear Eng. 5, 61-4(1960) Feb.

Results are presented from irradiation tests on Santowax-R and terphenyl which are to be used in organic moderated and cooled reactors. The only satisfactory way in which the higher G-values for pile irradiation can be explained is by assuming that the G-value for fast neutron irradiation is greater than that for gamma radiation. The assumption of greater damage by neutrons and other densely ionizing radiations is supported by Harwell work on the irradiation of benzene solutions of triphenyl boron, but is by no means confirmed for all organic systems. A continuous investigation is in progress on the radiation effects of these organic materials. (B.O.G.)

9182

TWO ATOMIC REACTORS CONSIDERED AS PHYSICS INSTRUMENTS. P. Delattre (Centre d'Études Nucleaires, Saclay, France). Nuclear Instr. and Methods 6, 83-93 (1959) Dec. (In French)

From a certain standpoint, the EL-2 and EL-3 laboratory reactors can be considered as nuclear physics instruments, in the same way as particle accelerators. The essential difference between accelerators and laboratory reactors lies in the fact that the latter are not solely used for fundamental research but also for research in applied physics, technology, chemistry, etc. The operation of laboratory reactors and their use for research purposes leads to a number of general problems. Four precise examples selected among these general problems describe the methods used to solve such problems and the necessary preliminary studies. (auth)

9183

EFFECTS OF THE CONTAMINATION BY LIGHT WATER ON LATTICES OF NATURAL URANIUM RODS IN HEAVY WATER. Bernard S. Finn and James W. Wade (E. I. du Pont de Nemours & Co., Aiken, S. C.). Nuclear Sci. and Eng. 7, 93-6(1960) Feb.

The effects of H_2O contamination on lattices of natural uranium metal in D_2O were measured. The buckling changes associated with H_2O contamination were determined for two lattices with moderator-to-fuel volume ratios of 12.3 and 14.6 over a range of H_2O concentrations from 0.2 to 8.2 mole %. The agreement between calculated and experimental changes in buckling for these lattices was within $\pm 25 \times 10^{-6}$ cm^{-2}. Similar measurements on seven other lattices with moderator-to-fuel ratios in the range from 31 to 212 were made for a change in the H_2O concentration from 0.18 to 3.92 mole %. For these measurements the experimental change in buckling was about 15% greater than the calculated change. (auth)

9184

THERMAL STRESSES IN NUCLEAR REACTOR VESSEL NOZZLES. J. S. Busch, A. J. Martenson, and S. W. Sinderson (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 7, 97-103(1960) Feb.

The thermal stresses in the nozzles of heavy-walled reactor vessels, caused by sudden changes in coolant temperature, are considered. An analysis was made of this problem for both high and low flows of cold water. The results show that the nozzle investigated (stainless steel clad nozzle) can endure a large number of cycles of the worst case analyzed. (auth)

9185

ACCURACY OF THE S_n CODE IN CELL CALCULATIONS. A. V. Campise (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 7, 104-10(1960) Feb.

A study was made of the ability of the S_n form of the neutron transport equation to describe accurately the thermal neutron flux distribution in a unit cell. The uncertainties introduced into the problem by spectrum hardening in heterogeneous cells were minimized by confining most of the comparison of theory with experiment to natural uranium rods in diphenyl and D_2O. Results are

evaluated on the basis of the S_n method's ability to calculate adequately the spatial variation of the thermal flux distribution when compared with experiment. Excellent agreement was obtained for the S_n calculations. (auth)

9186

THE USE OF THE GENERATION TIME IN REACTOR KINETICS. Jeffery Lewins (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 7, 122-6(1960) Feb.

The operational and conceptual significance of the reactor kinetics parameters is considered, with reference to the generation time, the reciprocal production probability. The kinetics equations are given in a form parametric in the generation time. Solutions are given for several problems containing time varying coefficients. (auth)

9187

GREULING-GOERTZEL CALCULATIONS IN HEAVY WATER. R. J. Mack and P. F. Zweifel (Univ. of Michigan, Ann Arbor). Nuclear Sci. and Eng. 7, 144-6(1960) Feb.

The Greuling-Goertzel approximation is applied to the calculation of neutron slowing down in heavy water in the B_1 and P_1 approximations. Numerical calculations of the flux and nonescape probability assuming constant cross sections indicate the "inconsistent" Greuling-Goertzel B_1 approximation to be the most favorable. (auth)

9188

STATISTICAL ANALYSIS OF HOT CHANNEL FACTORS. P. A. Rude and A. C. Nelson, Jr. (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 7, 156-61(1960) Feb.

A statistical method for determining and interpreting the combined as well as individual hot channel factors is given. The factors are considered to be cumulative with the over-all hot channel factor at a point in the reactor being considered the product of all factors applicable at the point. (C.J.G.)

9189

COLLISION PROBABILITIES AND RESONANCE INTEGRALS FOR LATTICES. Wolfgang Rothenstein (Brookhaven National Lab., Upton, N. Y.). Nuclear Sci. and Eng. 7, 162-71(1960) Feb.

A formula for the escape probabilities of neutrons from the fuel lumps to the moderator and vice versa in a lattice is derived and the validity of simple approximations discussed. These formulas are applied to solve the coupled integral equations for the collision densities in a lattice. First-order corrections to the resonance integral are obtained both for the narrow resonance and the narrow resonance infinite absorber approximations. Numerical results are given for water lattices containing hexagonal arrays of U^{238} rods, of 0.25 and 0.60 in. diameter, at different water-to-metal volume ratios. (auth)

9190

MANY-FOLD MOMENT METHOD. D. Schiff and S. Zierling (Raytheon Co., West Newton, Mass.). Nuclear Sci. and Eng. 7, 172-83(1960) Feb.

An extension of Yvon's method to two-dimensional transport theory is given. The detailed formalism in P_1 approximation is presented. Some pilot calculations on two-dimensional critical sizes are presented both for bare and reflected reactors. A brief outline of extending this method to both three-dimensional or multigroup problems is given. (auth)

9191

MODEL TEST FOR XENON POISONING IN NUCLEAR REACTORS. K. Hecht. Nukleonik 2, 37-8(1960) Jan. (In German)

An outlet tube apparatus is described which shows increases and decreases of fission products in a reactor and accordingly it indicates Xe^{135} buildup in a reactor after shutdown. Two outlet tubes with capillary filters are connected to a constant-level distilled water jar by a stop-cock so that water flows by gravity through the tubes to another stop-cock at the bottom of the tubes. The flow of water into the top tube represents the constant thermal neutron flux. The water levels in the upper and lower tubes represent I^{135} and Xe^{135} decay. Operation of the model is described and discussed. (T.R.H.)

9192

A CRITERION FOR THE DETERMINATION OF REACTOR REGIONS WITH POSITIVE AND NEGATIVE VOID COEFFICIENTS. H. Dušek (Siemens-Schuckertwerke AG, Erlangen, Ger.). Nukleonik 2, 38-39(1960) Jan. (In German)

If a hollow space develops in a critical system (from overheating, for example), the sign of the combined void coefficients of reactivity depends upon the position of the voids in the reactor. In order to answer the question as to the regions with positive and negative void coefficients in the most general form, a reactor geometry with a fitted coordinate system is selected and it is assumed that the unperturbed neutron flux and its corresponding influence function are determined analytically within the limits of an n-group calculation. The calculations are shown. (T.R.H.)

9193

NUCLEAR SAFETY. Technical Progress Reviews, Vol. 1, No. 2. W B. Cottrell, ed. Oak Ridge, Tenn., Oak Ridge National Lab., 1959. 70p. $0.55(GPO) domestic; $0.70 foreign.

The first section is devoted to nuclear safety criteria and discusses the AEC reactor safety program, site selection criteria, safety in the handling of fissionable materials, and atomic energy hazards. Accident analysis is discussed in the second section and includes fission product release from UO_2, chemical reactions of reactor materials, release of Wigner energy from graphite, and reactor kinetics calculations. In the third section reactor safety features are discussed and include aseismic reactor design, auxiliary and emergency electric power systems, and xenon instability. Plant safety features are presented in section four and include decontamination hazards, concrete pressure vessels, and fuel-reprocessing hazards. Section five is devoted to activity release and consequences and includes contamination of the lithosphere, radiation monitoring of large areas, and personnel exposures following accidental release. The last section presents current events and includes nuclear incidents, activities of the Advisory Committee on Reactor Safeguards, Experimental Gas-cooled Reactor safeguards review, and safeguards reports and bibliographies. (W.L.H.)

9194

JACKETED BODY. (to United Kingdom Atomic Energy Authority). British Patent 819,341. Sept. 2, 1959.

A fuel element canning procedure is described. The U is bonded in open-end cans, two of which are then welded and bonded end-to-end to provide a leak-proof seal. The arrangement of the seal is such that internal pressure from reaction with water leaking in tends to force material into the coolant stream for rapid detection of a leak. (T.R.H.)

9195

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Oscar Bunemann (to United Kingdom Atomic Energy Authority). British Patent 819,468. Sept. 2, 1959.

A reactor which uses breeder material coated with fis-

sile material in the fuel elements is described. In one example ThC powder pressed into rods 1-in. diam by 3- to 12-in. length is wrapped with Pu steel weighing 0.5% of the ThC. The wrapped rod is canned in Al and used as a U substitute in a natural-U reactor. After discharge from the reactor the can is dissolved and the Pu removed and processed, while the ThC is put into another fuel element for irradiation to the desired U^{233} production level. Alternatively, the ThC may be replaced by U which can be re-used as seed elements in the reactor. These seed elements are rods of natural U, depleted U, or Th wrapped in Pu sheet and canned in Al. (T.R.H.)

9196

IMPROVEMENTS RELATING TO NEUTRONIC REACTION FUELS. (to General Electric Co.). British Patent 826,529. Jan. 13, 1960.

A modification to patent number 796,989 is offered. The fuel alloy composition previously described is altered in that U^{233} or a mixture of U^{233} and U^{235} can be substituted for the U^{235}. (T.R.H.)

9197

IMPROVEMENTS IN OR RELATING TO PROTECTIVE CANS FOR NUCLEAR REACTOR FUEL ELEMENTS. Peter Arnold Lindley (to General Electric Co., Ltd.). British Patent 828,351. Feb. 17, 1960.

A finned fuel element design is offered. The fins are part longitudinal and part helical, the helical fins being outermost and extending across the longitudinal fins. (T.R.H.)

Power Reactors

9198 AECL-945

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE OCDRE PROGRAM. W. M. Campbell. Oct. 1959. 17p. AECL.

Design parameters for an organic cooled deuterium reactor (OCDR) are given. The development program (OCDRE) for such a reactor is discussed. (C.J.G.)

9199 APAE-Memo-126

Alco Products, Inc., Schenectady, N. Y.

APPR-1 BURNOUT CALCULATIONS. T. G. Williamson. Apr. 10, 1958. 34p. Contract AT(30-3)-278. OTS.

A general non-uniform burnup program was developed to determine the lifetime of the APPR-1. The calculation is performed using two one dimensional multi-region burnout calculations. The approach to the problem, the equations, and derivation of burnout equations are presented. The results are plotted and compared with the rod bank position as measured at Fort Belvoir. On the basis of these calculations the expected total energy release of the APPR-1 is 13 Mw-yr. (auth)

9200 APAE-Memo-213

Alco Products, Inc., Schenectady, N. Y.

CORE CHARACTERISTICS OF FOUR ARMY PACKAGE POWER REACTORS. J. G. Gallagher, M. J. Leibson, and B. J. Byrne. [1959]. 19p. OTS.

Presented at the 1959 Annual Meeting, American Nuclear Society, Gatlinburg, Tennessee, June 15, 1959.

A brief discussion of the core characteristics of four uranium fuel, pressurized-water type Army Package Power Reactors, the SM-1, SM-1A, PM-2A, and SM-2, is presented. The characteristics discussed are cell geometry, fuel plates, core geometry, flux distributions, core loading, core burnout, and control rods. Tables and illustrations are included. (auth)

9201 BAW-1085

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

LIQUID METAL FUEL REACTOR EXPERIMENT. PRELIMINARY TESTING OF FLANGES FOR LIQUID U–Bi SERVICE. Oct. 1959. 32p. OTS.

A freeze seal flange and a gasketed joint were tested to determine the feasibility of using a flange-type mechanism to seal against U–Bi solution. Both joints were made of Croloy $2\frac{1}{4}$. Although the tests were not completed, the freeze seal design shows more potential for LMFRE application. The tests conducted were helium leak tests, uniform temperature tests, and temperature cycling tests. (auth)

9202 BMI-1397

Battelle Memorial Inst., Columbus, Ohio.

MODEL STUDIES OF FLOW AND MIXING IN THE PARTIALLY ENRICHED GAS-COOLED POWER REACTOR. Lawrence J. Flanigan, Gale R. Whitacre, and Herbert R. Hazard. Nov. 30, 1959. 36p. Contract W-7405-eng-92. OTS.

A quarter-scale flow model, using air as a working fluid, was used to obtain design data for the PEGCPR program. A design for the core-support cylinder, to provide optimum mixing and core-flow distribution, was developed, following which experimental studies of core-flow distribution, mixing of flow from the two inlets, flow patterns in plenum spaces, flow patterns in the thermal-shield-coolant passage, and pressure drops throughout the model were carried out. Results obtained in the model were then converted to values applicable to helium flow in the prototype. (auth)

9203 DP-435

Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.

HEAVY WATER MODERATED POWER REACTORS. Progress Report [for] October 1959. R. R. Hood and L. Isakoff, comps. Nov. 1959. 23p. Contract AT(07-2)-1. OTS.

Continued progress is reported on the design and construction of the Heavy Water Components Test Reactor; 78% of the firm design and 17% of the construction were complete at the end of October 1959. Approximately 15% of the firm design for the isolated coolant loops of the HWCTR was also complete. The results of further fabrication tests and irradiation tests of fuel tubes of natural uranium metal are reported. One of the metal tubes failed under irradiation, while other irradiations of metal fuels progressed satisfactorily. (auth)

9204 HPR-3

Norway. Institutt for Atomenergi, Halden.

HBWR PHYSICS EXPERIMENTS. H. Ager-Hanssen, G. Apelqvist, P. Blomberg, K. Bryhn-Ingebrigtsen, C. F. Höjerup, G. Ingram, and N. Standal. Jan. 1960. 108p.

The Halden Boiling Water Reactor is a heavy water moderated reactor fueled with natural U. The experimental program to be carried out with HBWR includes experiments with two different fuel charges: one with natural metallic U canned in Al and 1.5% enriched U oxide elements canned in Zircaloy. The total fuel investment in the first charge is 7 tons of U and the total D_2O investment is 16 tons. The 7 tons of U are shared between 296 fuel elements which are arranged in a hexagonal lattice. In the second charge the total fuel investment will be ~2 tons and will be operated with a radial heavy water reflector of ~55 cm. (W.L.H.)

9205 NAA-SR-4389

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DEVELOPMENT OF THE MARK A SAFETY ROD FOR THE

HALLAM NUCLEAR POWER FACILITY. R. E. Douglas. Mar. 1, 1960. 25p. Contract AT-11-1-GEN-8. OTS.

A mechanical safety rod in the control system of the Hallam Nuclear Power Facility is required to make the reactor subcritical in an emergency arising from unusual operating conditions. A prototype safety rod was designed and fabricated for use in a developmental test program. Critical components, including the scram magnet, control element assembly, and the snubber system were tested; results were compared with performance requirements to establish conformity. The developmental model of the completed safety rod assembly was then tested. A total of 581 cycles of operation was obtained at ambient air temperature conditions, thus concluding the first phase of the safety rod developmental testing. (auth)

9206 NAA-SR-4390

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DEVELOPMENT OF THE MARK A CONTROL ROD FOR THE HALLAM NUCLEAR POWER FACILITY. W. A. Kaspic. Mar. 1, 1960. 22p. Contract AT-11-1-GEN-8. OTS.

A development program was initiated to design, fabricate, and test for conformance to specifications a shim regulating rod for the Hallam Nuclear Power Facility (HNPF). A prototype mechanism was designed and fabricated on the basis of experience gained from the operation of control rods in the Sodium Reactor Experiment (SRE). The mechanism was tested in a furnace at temperatures approximating those expected in the reactor. One million inches of poison rod travel during the test phase successfully demonstrated the design concept. (auth)

9207 ORNL-2198

Oak Ridge National Lab., Tenn.

ANALYTICAL AND EXPERIMENTAL STUDIES OF THE TEMPERATURE STRUCTURE WITHIN THE ART CORE. H. F. Poppendiek, N. D. Greene, L. D. Palmer, G. L. Muller, and G. M. Winn. Feb. 19, 1957. Decl. Nov. 24, 1959. 106p. Contract W-7405-eng-26. OTS.

The temperature structure within the core of the ART was studied for several different entrance flow conditions. Both analytical and experimental techniques of analysis are used in the investigation. Mean and transient temperature fields are predicted on the basis of the mathematical behavior of idealized cores. These results are compared with experimental temperature measurements obtained in a half-scale model of the ART core, within which the volume heat sources are generated electrically. The heat transfer studies revealed the following facts about the ART core: (1) Unless the core shell walls are cooled, maximum wall temperatures ranging from 1750 to 1850°F (depending upon the type of entrance flow) will exist near the core exit and necessitate removal of ~3% of the heat generated within the core to accomplish the cooling task. (2) Unless the sodium coolant flows through the cooling annuli in a uniform fashion, hot and cold spots will exist in the core shells. (3) Peak fuel temperatures at the core exit, under wall cooling conditions, will be from 100 to 170°F higher than the mixed-mean fuel temperature (depending upon the type of entrance flow). (4) The temperature structure within the core is significantly asymmetric with respect to peripheral position when one pump is not in operation. (5) The core shell interface and fuel temperatures are transient in nature (frequency spectrum ranges from about ½ to 4 cycles per second). Some of the general principles upon which circulating-fuel reactors should be designed from the standpoint of heat transfer and fluid flow are discussed. Several reactor cores other than the ART are reviewed. (auth)

9208 ORNL-2879

Oak Ridge National Lab., Tenn.

HOMOGENEOUS REACTOR PROGRAM PROGRESS REPORT FOR PERIOD MAY 1 THROUGH OCTOBER 31, 1959. Feb. 10, 1960. 273p. Contract W-7405-eng-26. OTS.

Homogeneous Reactor Test. The reactor was in operation for over 2500 hr, including a continuous run of 1364 hr. Measurements were made to determine the reactivity loss resulting from buildup of Xe in the high-pressure system. A series of experiments is in progress to determine the catalytic properties of Cu for D_2-O_2 recombination. The multiple hydroclone installed in the reactor cell prior to HRT run 20 was operated throughout the run. In the past year, corrosion-product solids were produced at a rate no higher than 1.6 g/hr and removed at an average rate of 1.1 g/hr. A substantial holdup of iodine in the reactor high-pressure system was confirmed. Calculations based on Cs^{137}/Cs^{135} mass ratios showed the Xe is also being held up longer than was anticipated. Several remote operations were performed at the HRT after run 20. Tools for modification of the HRT core were designed and fabricated. A test of two HRT prototype feed-pump heads was discontinued after 19,256 hr of operation. The activity hazards in the HRT steam system associated with a ruptured heat exchanger tube were re-evaluated. The feasibility of using a flowmeter for measurement of HRT feed flows is being investigated. The HRT feed shutoff valve was replaced. Reactor Analysis and Engineering Development. A study was made of the nuclear statics characteristics of small two-region reactors containing 1000 g of Th per liter in the blanket region, a solution core, and a water moderator with various percentages of D_2O. Studies were made of the effect of region composition on the power generated within in-pile loops. A 2500-hr operating test at 1500 psi was completed successfully by the natural-circulation recombiner. Testing of a 20 cfm canned-motor blower was terminated by a stator failure after a long period of successful performance at 225°C and 1500 psi. Runs with the 300 A slurry pump were continued to test improved designs of pump parts. The mechanically mounted Al_2O_3 bearing in the 300 A pump was operated satisfactorily. Tests of a 4-ft-diam spherical re-entrant core model were completed with measurement of the velocity distribution near the core wall. Preliminary tests of a cylindrical core with swirling flow were promising from the standpoint of blanketing the core wall with cool fluid. A new 50-gpm Byron-Jackson canned-motor pump circulated an 800°C-fired digested ThO_2 in the 200 A loop successfully. A general relationship was derived for predicting the effect of temperature on the settled-bed density and yield stress of slurries in small tubes. The differential transformer developed for use at high temperatures and in radiation fields was operated for three months at 300°C without change of characteristics. Heat transfer measurements were made using an electrically heated stainless steel tube in degassed and in oxygenated H_2O, D_2O, and uranyl sulfate solution circulated at 100 to 250°C and at pressures from 300 to 1000 psia. Solution Fuels. Reaction rates were measured for the four combinations of H_2 and D_2 with H_2O and D_2O in 0.1 M $Cu(ClO_4)_2$ solutions. The effectiveness of cupric ion as a catalyst in a $UO_3-HNO_3-H_2O$ fuel system was investigated. Study of the boundaries of the liquid-liquid immiscibility regions of systems having compositions related to that of HRT fuel reveals that the two-liquid-phase temperatures pass through minimal values at concentration factors of 2x to 10x. Determinations from 300 to 350°C were made of the

compositions of light and heavy phases in the systems $UO_3-SO_3-H_2O$ and $UO_3-SO_3-D_2O$. Two additional binary curves at 300°C were established in the system $UO_3-CuO-NiO-SO_3-H_2O$ (D_2O). Temperatures of formation of two-liquid phases were determined in the system $UO_3-SO_3-N_2O_5-H_2O$. The corrosion rates of stainless steel in fuel solutions were investigated. The effect of reactor radiation on the over-all corrosion rate of the loop components was continuously monitored by measurement of oxygen consumed and by frequent removal of solution samples for chemical analysis. Studies of the radiation induced corrosion of Zircaloy-2 in 0.04 m UO_2SO_4 solutions are reported. The deposition of U in the core under conditions of low solution-flow rate and low overpressure was studied. Core specimens of crystal-bar Zr, Zr-5% Sn, Zr-15% Nb, Zr-15% Nb-5% Mo, and Zr-15% Nb-2% Mo exhibited corrosion rates which, with two exceptions, were from 1.4 to 2.5 times greater than those for similarly located Zircaloy-2 specimens. A Zr-1% Cr alloy was tested along with Zircaloy-2 control specimens under irradiation in contact with a UO_2SO_4 solution at 275°C. A scouting experiment dealing with the $Cr^{3+} \rightleftharpoons Cr^{6+}$ equilibrium in UO_2SO_4 solution under irradiation was carried out. Measurements of the adsorptive capacity of hydrous ZrO_2 for U from UO_2SO_4 solutions at high temperature were continued. Electrochemical measurements of Zircaloy-2 corrosion in oxygenated H_2SO_4 at 208°C were continued. Slurry Fuels. An extension of the Bingham-plastic model for interpreting laminar-flow data with ThO_2 slurries was attempted. A study of data for suspensions of glass beads, steel and lead shot, sand, and ThO_2 in water is presented. Evidences of chemisorption on ThO_2 prepared by oxalate precipitation with calcination at 800°C were found in water-vapor adsorption studies. A slurry of ThO_2 containing 8% natural U and fired at 1050°C was irradiated 370 hr at 300°C in the LITR. Three experiments in the ORNL Graphite Reactor with 500 and 250 g of Th per kg of D_2O slurries of 650°C-fired Th–2.8 U^{235} oxide and a 250-g/kg D_2O slurry of 1000°C fired Th–3% U^{235} oxide irradiated under oxygen atmospheres showed gas production rates corresponding to G values of ~0.8. The solubility of hydrogen on aqueous slurries was determined. Development of a catalyst for the internal recombination of radiolytic gas in Th and Th–U oxide continued. A new gas-injection apparatus was developed for gas-recombination measurements. In a series of six 100A-loop tests of 400 to 800 hr duration which were conducted to evaluate the chemical, circulation, and corrosion-erosion properties of heavy-water slurries of mixed Th-U oxides no change in the $U^{4+}/^{\Sigma}U$ ratio of the oxides was observed in tests conducted at 200 and 280°C, using oxygen atmospheres. At a mean slurry concentration of 500 g of U-bearing Th per kg of D_2O, corrosion-erosion attack closely approximated by slurries of pure ThO_2. The corrosive attack of Inconel, stainless steel, Ti, and Zircaloy-2 by D_2O slurries of Th–U was investigated. Fuel Manufacture and Processing. Procedures were demonstrated by using HRT-scale equipment for the electrolytic removal of Ni from UO_2SO_4 fuel solution and the regeneration of the resulting amalgam with 1 M HNO_3 and 1.5% H_2O_2 in order to remove the Cu and Ni. Soluble corrosion and fission products were removed from a simulated fuel solution by the precipitation of UO_2 and metallic Cu with hydrogen at 250°C. Work on the development of oxide preparation methods continued. Metallurgy. The macro- and microexaminations of the specimens removed from the HRT core tank after run 17 were completed. The thickness of the HRT core vessel was measured ultrasonically. The fabrication study of Zircaloy-2 was essentially completed. Analytical Chemistry. A method is discussed for the determination of microgram quantities of Mo in slurries of ThO_2-UO_2. An improved method is described for the determination of free acid in the fuel solution of a homogeneous reactor. (For preceding period see ORNL-2743.) (W.L.H.)

9209 TID-5431

Ford Motor Co., Dearborn, Mich.

THE APPLICABILITY OF HIGH PRODUCTION METHODS TO NUCLEAR POWER REACTOR FUEL ELEMENT FABRICATION. Charles W. Phillips, George Pascoe, and Dominic Leonatti. July 1, 1956. Decl. Nov. 10, 1959. 49p. OTS.

A study of the applicability of mass production methods to the fabrication of the Experimental Boiling Water Reactor plate-type, metallurgically-bonded fuel element and the Pressurized Water Reactor UO_2 rod-type, unbonded fuel element was made. Several production processes were examined in detail, with particular attention to the type and cost of equipment, necessary manufacturing area, and number of operators required. Three process modifications for the plate element were compared; one process for the rod element was investigated. It was found that the plate element design is not well adapted to mass production processes primarily because of the requirement of metallurgical bonding. The rod element design, on the other hand, is suitable for the use of mass production methods. (auth)

9210 TID-8503(Pt. 4)

Sargent and Lundy, Chicago and Nuclear Development Corp. of America, White Plains, N. Y.

HEAVY WATER MODERATED POWER REACTOR PLANTS DESIGN STUDY—SUMMARY OF PARTS 1-3. June 1959. 82p. Contract AT(38-1)193, Mod. 1. OTS.

Previously available as SL-1653.

A design study of heavy-water-moderated power reactor plants is summarized. The over-all study had two objectives: selection and recommendation of a conceptual design of a heavy water moderated power reactor plant providing optimum economics with slight fuel enrichment, but capable of operating with natural U fuel, and preparation of preliminary design and cost estimates of a prototype power reactor plant of the minimum size necessary to demonstrate the recommended concept. Each design was based on currently available technology and that development which could be undertaken concurrently with plant design and construction. The design was based on a prototype operating date of mid-1963. (W.L.H.)

9211 TID-10095

Argonne National Lab., Lemont, Ill.

HEAVY WATER–ZIRCONIUM–THORIUM TYPE POWER CONVERSION REACTOR. J. B. Anderson, R. Avery, J. R. Dietrich, E. F. Fricke, W. C. Gumprich, H. P. Iskenderian, P. G. Kollberg, G. I. Moller, J. F. Munn, S. Naymark, D. H. Shaftman, and L. J. Templin. Feb. 1, 1951. Decl. Oct. 7, 1959. 57p. Contract W-31-109-eng-38. OTS.

Results of an investigation concerning the conversion of fertile material to fissionable material are presented. Also, design of a heavy water cooled reactor is described. Aspects of heavy water reactor types are discussed, and methods used for reactor physics calculations are outlined. (J.R.D.)

9212 WAPD-MRP-83

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD

OCTOBER 24, 1959 TO DECEMBER 23, 1959. 125p. Contract AT-11-1-GEN-14. OTS.

Power Plant Support. A design for installing flat-type submarine doors on the existing doors of air locks is presented. The main coolant pump No. 80 was disassembled for inspection to determine why it would not start after being in a hot layup condition for ~25 days. Metallurgy. Preliminary examination of two fuel plates of the X-3-1 test containing 0.040 in. thick UO_2 fuel platelets indicates that swelling has occurred after exposure of $\sim 25 \times 10^{20}$ fissions/cc. Preliminary examination of BeO–UO_2 fuel plates from the WAPD-29-21 test indicates that swelling of these fuels has occurred after $\sim 10 \times 10^{20}$ fissions/cc; the swelling is accompanied with high fission gas and helium release. Analysis of the final specimen on the thermal diffusion of hydrogen in Zircaloy-2 showed substantial hydrogen migration to the cold side, causing precipitation of a large amount of metal-free zirconium hydride. Physics. Three-dimensional depletion studies of PWR-1 Seed 2 were continued. The effects on the local seed power peaking factors of poison element location and of control rod extensions were studied utilizing several analytical models. Measurements were made in fuel plates containing natural U oxide wafers of a quantity related to the resonance escape probability. (For preceeding period see WAPD-MRD-83.) (W.L.H.)

9213 YAEC-31(Suppl.)

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

YANKEE CRITICAL EXPERIMENTS; HAZARDS SUMMARY REPORT. D. F. Hanlen, D. Hunter, and J. Jedruch. May 1, 1958. 44p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

The hazards associated with a series of experiments in the Yankee Power Reactor in which the water-to-uranium metal ratio is 2.23 to 1 are evaluated. Descriptions are given of the site, reactor facility, and reactor control system. An accident and hazards analysis was made relative to failure or malfunction of components, hazards from human error, sabotage, and hazards occurring from nature. The maximum credible accident and its consequences are discussed. (C.J.G.)

9214 NP-tr-344

ATOMIC ENERGY IN AVIATION AND ROCKET TECHNOLOGY. (Collection of Articles). (Atomnaya Energiya v Aviatsii i Raketnoi Tekhnike). I. Kurchatov, et al. Translated from a publication of the Military Publishing House of the Ministry of Defense, Moscow, 1959. 547p. OTS.

A description is presented of the possibilities and prospects of the utilization of nuclear energy in aviation and in the development of aviation and rocketry. (W.L.H.)

9215

TRANSFER FUNCTION OF BERYLLIUM MODERATED REACTORS. H. B. Smets (Centre d'Étude de l'Énergie Nucléaire, Mol-Donk, Belg.). Atompraxis 6, 1-3(1960) Jan. (In English)

Comparison of the low power transfer functions of reactors with and without delayed photoneutrons generated in beryllium shows that the effect of the photoneutrons on the transfer function is negligible for frequencies above 10^{-2} sec^{-1}. The eleven groups of photoneutrons can be approximated by three equivalent groups, and determination of the multiplication factor can be made by measurement of the phase of the transfer function. (auth)

9216

COMPARISON OF D_2O- AND CO_2-COOLED HEAVY-WATER REACTOR. H. N. Schludi and H. Plank. Atompraxis 6, 3-7(1960) Jan. (In German)

Two 100-mw reactors have been investigated and compared with one another. Both reactors use heavy water as moderator and natural uranium dioxide as reactor fuel. The coolant of the one of the two reactors is D_2O and the fuel cladding used Zircaloy-2. Coolant outlet temperature is 290°C, and coolant pressure was chosen to be 100 atm. The coolant of the other reactor is CO_2 and the fuel cladding used beryllium. The coolant outlet temperature of the CO_2-coolant is 550°C and the coolant pressure of the hot gas 75 atm. The investigation showed the advantages of the gas coolant compared with water coolant. The advantages of the gas coolant are primarily due to the better thermal efficiency which can be achieved with gas coolant. (auth)

9217

REACTOR SYSTEMS FOR SHIP PROPULSION–A COMPARISON. W. A. Hepburn (Maritime Administration, Washington, D. C. and U. S. Atomic Energy Commission, Washington, D. C.) and D. H. Specht (Maritime Administration, Washington, D. C.). Atomwirtschaft 5, 9-13(1960) Jan. (In German)

A comparison study of four reactor types PWR, BWR, GCR, and OMR for the propulsion of merchant ships was carried out on the basis of a 30,000 HP installation. Efficiency, control, cooling problems, build-up of radioactivity and fuel changing of the different systems were compared with reference to the operation, maintenance, and safety of the reactor. The study led to the conclusion that, for rapid application, the water systems are indicated but that, looking further ahead, the optimum solution lay in a gas-cooled reactor with gas turbines. (auth)

9218

NUCLEAR ROCKETS. O. H. Wyatt (Hawker Siddeley Nuclear Power Co., Ltd., London). Hawker Siddeley Tech. J. No. 3, 46-50(1959).

Various types of reactors for nuclear rockets are discussed relative to the fissile materials and critical masses. Pressure drop and heat transfer calculations are made for hydrogen and ammonia as propellants for U^{235} graphite-moderated and Pu^{239} graphite-moderated reactors. Weight analysis and rocket performance data are given for the two previously mentioned reactors. Design optimization and radiation hazards are discussed. Burnout velocities of nuclear rockets are compared with chemical rockets. (C.J.G.)

9219

EARTHQUAKE RESISTANCE DESIGN OF CALDER HALL IMPROVED TYPE POWER REACTOR TO BE ERECTED IN TOKAI MURA. I. PHILOSOPHY OF ASEISMIC DESIGN AND THE PROPOSED SPECIFICATIONS FOR THE REACTOR. K. Mutō (Univ. of Tokyo). J. Atomic Energy Soc. Japan 1, 447-55(1959). (In Japanese)

Descriptions are given of the site of the reactor from the viewpoint of seismology and subsoil condition as well as of the basic idea of aseismic design with proposed specification based on the foregoing idea. In drawing up the seismic specification, as this reactor is the first large scale reactor in Japan, the safety of the reactor itself and the protection of residents near the reactor from damage during an earthquake were made the primary requisites. From this viewpoint, the seismic coefficient exceeding 0.2 stipulated in the Japanese Building Code was adopted: particularly with regard to the main part of the reactor, the horizontal seismic coefficient was required to be 3 times the standard value and the vertical seismic coefficient

one-half of the horizontal coefficient. Also, lest relative displacements between each part of the reactor during earthquakes should hinder the operation, the whole building and structures were made rigid, i.e., the graphite core structure was supported by a steel cylinder and the pressure vessel, steam raising units and gas ducts were firmly fixed to the biological shield concrete. The actual design drawn up by the G. E. C. based upon the aseismic specifications will be described in Part II. (auth)

9220

OMRE. OPERATING HISTORY AND EXPERIENCE. K. H. Campbell (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Eng. 5, 53-7 (1960) Feb.

An account is given of the operating history and experience gained from September 1957 to August 1959. At the time of the August 1959 shutdown, the reactor had accumulated a total of 1,400 Mwd of operation, 958 Mwd on the first core loading and 442 on the second. The decomposition rates of the organic coolant were calculated from total energy absorbed. Three fuel elements were removed for detailed inspection of heat transfer surfaces. The first two elements were removed after 549 and 958 Mwd at a nominal temperature of 750°F. The third element was removed from the second core loading after 442 Mwd of operation at temperatures slightly greater than 800°F. Mechanical and corrosion test specimens were exposed to measured integrated neutron fluxes of the order of 9.0×10^{19} nvt thermal and 2.8×10^{20} nvt fast. The corrosion studies on out-of-pile specimens from the by-pass line were compared to the in-pile test specimens. The experience gained from the two years in which the OMRE was operational can be evaluated with some confidence with respect to the originally conceived economic and operating advantages inherent in the concept. (B.O.G.)

9221

THE OMRE FACILITY. Nuclear Eng. 5, 58(1960) Feb.

A description is presented of the principal characteristics of the OMRE. The 12 control rods consist of steel tubes loaded with 36 in. of compacted boron carbide powder. The fuel elements are stainless steel–UO_2. The cooling system circulates 9,200 gal/min of coolant from the reactor to an air blast heat exchanger. The by-pass heater loop affords continuous information on the hydrocarbon heat-transfer property change during reactor operation. The purification system, a distillation unit operating at 20 mm Hg absolute, separates the damaged coolant and returns the undamaged with fresh make-up to the system. A cut-away drawing of the layout of the reactor is included. (B.O.G.)

9222

OM FUEL ELEMENTS. O. H. Wyatt (Hawker Siddeley Nuclear Power Co., Ltd., [Manchester, Lancs, Eng.]). Nuclear Eng. 5, 64-6(1960) Feb.

The construction of fuel elements chosen for the Hawker-Siddeley marine propulsion power plant is described. Considerations were presented concerning the choice of uranium dioxide and stainless steel as the fuel and container. S. A. P. (sintered aluminum powder) is regarded as the next and possibly best can material with a strength/absorption ratio of about four times better than steel. In the arrangement of the fuel elements in the tube bundle, considerations must be given to thrust stress which is absent in mainland reactors. The construction must display a satisfactory rigidity without causing undue thermal stresses. (B.O.G.)

9223

ENGINEERING DESIGN OF PIQUA OMR. E. F. Weisner (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.) Nuclear Eng. 5, 68-71(1960) Feb.

The Piqua reactor is rated at 44.5 Mw(t). Fuel elements consist of a metallic uranium alloy enriched to 1.9 wt.% U^{235}, metallurgically bonded to the aluminum cladding using a nickel diffusion barrier. The air-blast heat exchanger used in the OMRE was replaced by steam generators, the total electrical output of which is 11.4 Mw. Added safety precautions were taken by providing a shielded containment vessel around the reactor and main heat transfer system. Operation is scheduled for 1961. (B.O.G.)

9224

ECONOMICS OF LARGE ORGANIC REACTORS. R. Berman (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Nuclear Eng. 5, 72-4(1960) Feb.

An outline is presented of the factors which influence the economics of large organic moderated and cooled reactors. The economic analysis of a 300 Mw(e) nuclear power station is given and compared with a conventional coal-fired station of 305 Mw(e). The comparison shows that the power costs were 7.31 and 6.77 mil/kwh, respectively. From this economic presentation, it is assumed that the organic moderated reactor has the potential of producing truly competitive electric power in less than a decade. (B.O.G.)

9225

ADVANCED WATER REACTOR SYSTEMS. THREE DESIGNS BY WESTINGHOUSE. Nuclear Energy 14, 11-13 (1960) Jan.

Designs and general operating principles of two plants using water reactor systems for power production are given. One plant is designed to use both nuclear and fossil fuel for producing an electric gross output of 225 Mw. The second plant is all-nuclear with integral superheating. The water is both boiled and superheated within the reactor core. Electrical power output is 20 Mw net. (C.J.G.)

9226

CALCULATION OF FERMI AGE AND LOSS FACTOR OF HETEROGENEOUS LIGHT WATER REACTORS BY THE MONTE CARLO METHOD. Wilhelm Matthes (Technische Hochschule, Munich). Nukleonik 2, 21-31(1960) Jan. (In German)

A Monte Carlo program is described with which one can obtain the Fermi age in heterogeneous U-rod water reactors by manipulation of a large number of single neutron histories. Consideration is given at once to all the processes involved (elastic and inelastic scattering, capture, intermediate and fast fission). The program gives the spatial distribution of fast and slow neutrons. An analysis was made of six quadratic lattices of cylindrical rods with volume ratios H_2O/U of 1, 2, and 3.5 and rod diameters D = 1.5 and 3 cm. Within the statistical limits of error, agreement between the calculated values and the experimental data of Barkov (1957) was obtained when corrections for source extension due to secondary super-thermal fissions were applied. The values measured for D = 3 cm by Kouts (1955) are considerably higher than those of Barkov and those calculated. Even greater discrepancies between theory and experiment appear for the lattice studied in which the volume ratio of H_2O/U was 1. An investigation was also made of the relation between Fermi age and the loss factor. It was found, among other things, that the loss factor for fast neutrons in a heterogeneous reactor has, as a good approximation, the same mathematical form as that

for a homogeneous reactor. It was further demonstrated that if the commonly used approximation model is applied (Fermi or two-group model), useful results for the loss factor are obtained. Also the loss factors obtained by the approximation model are compared with the ones based directly on an expanded Monte Carlo program. As secondary results the Fermi age for fission neutrons in water with $\tau = 28 \pm 2$ cm^2 and also the Fermi age for DD neutrons at 2.5 Mev with $\tau = 33$ cm^2 were found. (tr-auth)

9227

RESONANCE CAPTURE OF NEUTRONS IN BUNDLE-SHAPED ARRANGEMENTS OF FUEL ELEMENTS. Gerd Bläsner (Reaktorstation, Karlsruhe, Ger.). Nukleonik 2, 31-6(1960) Jan. (In German)

Calculations are presented for resonance capture of neutrons in absorber plates using the Wigner approximation. The values thus obtained for plate bundles are then compared on the basis of equal surface/volume ratios with experimental values for resonance capture in rod bundles. (tr-auth)

9228

NUCLEAR REACTOR PLANT DATA. VOLUME ONE. POWER REACTORS, 1959. New York, American Society of Mechanical Engineers, 1959. 132p.

A description of various nuclear power reactors including a schematic flow diagram, power and nuclear data, fuel element and blanket data, reactor core and control data, primary and secondary coolant data, and steam system data is presented. (C.J.G.)

9229

NUCLEAR SHIP PROPULSION. Holmes F. Crouch. Cambridge, Md., Cornell Maritime Press, 1960. 363p.

The objective of the book is to present a broad foundation of nuclear technology as it applies to the long-range growth of a large fleet of nuclear merchant ships. All non-ship nuclear principles have been weeded out, and the necessary technical interpretations and transpositions have been made. A knowledge of elementary maritime principles and nuclear physics is assumed in the reader. (W.D.M.)

9230

POWER REACTOR TECHNOLOGY. Technical Progress Reviews, Vol. 3, No. 1. Walter H. Zinn, [ed.] Dunedin, Fla., General Nuclear Engineering Corp., 1959. 68p. $0.55(GPO) domestic; $0.70 foreign.

General Research and Development. Section one of this volume is devoted to reactor applications and discusses the uses of process heat, process heat generation and consumption, and reactors for producing process steam. The second section discusses thermionic energy conversion and in particular the basis of operation, efficiency equation, estimates of attainable efficiencies, high-vacuum thermionic converter performance, experiments on a cesium-vapor-filled thermionic converter, and Los Alamos plasma thermocouple. In the third section the reactor physics of H_2O-moderated critical assemblies is discussed. The fourth section discusses heat transfer and fluid flow. Recent investigations are reported on the collapse of parallel-plate fuel assemblies, nucleate boiling, liquid-metal heat transfer, liquid metals with internal heat generation, and water flowing parallel to tube bundles. Section five is devoted to reactor kinetics and dynamics. Current investigations are reported on delayed neutrons in reactor kinetics, reduced delayed-neutron group representations, approximations for reactor accident calculations, oscillation experiments on large heavy-water reactors, and transfer functions of distributed parameter systems. In the sixth section reactor safety and containment are discussed. A review of shielding is present in the seventh section. In section eight the radiation effects on semiconductors and magnetic materials along with the corrosion of stainless steel in a nitrogen atmosphere are reported. Progress on Specific Reactor Types. The four sections comprising this part of the volume are devoted to light-water reactors, boiling-water reactors, fluid-fuel reactors, and fluidized-bed reactors. (W.L.H.)

9231

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Dennis William Ginns and Harold Howard Gott (to United Kingdom Atomic Energy Authority). British Patent 819,342. Sept. 2, 1959.

A gas-cooled graphite-moderated reactor with natural-U fuel is described. The moderator and concrete shield are enclosed in a steel vessel. The fuel elements are finned rods resting in cylindrical channels which open into one central coolant header or two terminal headers. Thus CO_2 at 5 atm. flows over the fuel elements to give good heat removal with economical pumping power. (T.R.H.)

9232

IMPROVEMENTS IN GAS COOLED NUCLEAR REACTORS. (to Commissariat à l'Énergie Atomique). British Patent 819,366. Sept. 2, 1959.

An arrangement for gas-cooled reactors is offered whereby leaking fuel element cans are quickly detected. The coolant is monitored by a beta radiation detection instrument. A valve arrangement allows selection of coolant channels to be monitored. (T.R.H.)

9233

IMPROVEMENTS IN STEAM GENERATING INSTALLATIONS. Andre Huet and Myron T. Herrick. British Patent 823,491. Nov. 11, 1959.

A steam generator arrangement is described for use in reactor installations. The economizer, evaporator, and superheater are suspended vertically with fixed supporting girders and elastic pipelines of small diameter. (T.R.H.)

9234

METHOD AND APPARATUS FOR NUCLEAR REACTOR SAFETY CONTROL. (to U. S. Atomic Energy Commission). British Patent 823,672. Nov. 18, 1959.

A reactor safety device is described. It consists of a means shaped like a fuel element to inject neutron absorbing fluid into the reactor when an unsafe condition exists. A vessel of BF_3 under pressure is connected to a low-pressure vessel by a solder plug. A uranium heater melts the solder plug at 221°C. In normal reactor operation a thermal resistance pad acts as a heat bypass so that the device is triggered only when the U heater heats up due to increased neutron flux. (T.R.H.)

9235

NUCLEAR REACTORS. (to U. S. Atomic Energy Commission). British Patent 827,085. Feb. 3, 1960.

A control system for a boiling reactor is offered which correlates power level to power demands and regulates feedwater temperature. Two feedwater distributor rings are placed above the core in the pressure vessel. The flow to the two rings is regulated by steam demand. An excessive steam demand causes a portion of the feedwater to be diverted from the lower ring to the upper. Feedwater entering by the lower ring increases reactor power level. Decrease in steam demand causes more of the feedwater to pass through the upper ring. Reactor startup and unloading are also described. (T.R.H.)

9236
IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR UNITS AND FUEL ROD ELEMENTS FOR USE THEREWITH. Jack Britt (to Rolls-Royce, Ltd.). British Patent 828,056. Feb. 10, 1960.

A reactor and fuel element designed for ease of loading and unloading are described. The fuel rod can has a spring-catch for fastening to a charge-discharge unit (described in patent No. 828,055) for manipulation. The reactor has catches for fastening the charge-discharge unit to it with proper alignment for fuel rod manipulation. (T.R.H.)

9237
NUCLEAR REACTOR CONTROL. Samuel Untermyer and Ernest Hutter (to U. S. Atomic Energy Commission). British Patent 828,352. Feb. 17, 1960.

A reactor control rod which is housed entirely within the reactor structure and which gives improved neutron flux distribution is described. The device is made up of three rods of alternating "absorber" and "neutral" zones of material which can be moved with respect to each other so that the absorber and neutral zones can be aligned or misaligned thus opening or closing passages for neutron flux. The movements of the rods do not require extension beyond the reactor proper. (T.R.H.)

9238
IMPROVEMENTS IN AND RELATING TO REACTOR PRESSURE VESSELS. Paul Heinz Walter Wolff and Henry Shull Arms (to English Electric Co., Ltd.). British Patent 828,468. Feb. 17, 1960.

A thermal shield to prevent a hot-spot at the top of gas-cooled reactor pressure vessels is described. In gas-cooled reactors where the coolant moves up through the core, a hot-spot is created where the heated gas impinges on the inside top of the pressure vessel. An arrangement of corrugated plates crosswise to each other is suggested to provide thermal insulation for this spot and make higher power levels possible with safer conditions for the pressure vessel. This corrugated-sheet stack can be cooled by gas moving outside the core. (T.R.H.)

Production Reactors

9239 CF-60-1-63
Oak Ridge National Lab., Tenn.
THORIUM BREEDER REACTOR STUDY: OPTIMIZATION OF A BLANKET PROCESSING CYCLE TO OBTAIN MINIMUM TOTAL INVENTORY IN A CHEMICAL REPROCESSING CYCLE. W. L. Carter. Jan. 21, 1960. 28p. Contract [W-7405-eng-26]. OTS.

A reactor which produces U^{233} from Th^{232} needs to operate with as low total inventory of fissionable and potential fissionable material, U^{233} and Pa^{233}, as possible in order to achieve short doubling times. The blanket processing cycle can be optimized to give minimum total inventory by the proper arrangement of Pa^{233} decay and U^{233} extraction steps. The optimization consists in choosing the proper storage time associated with each processing step. Graphs are presented correlating the optimized inventory with the number of processing cycles and the fraction of Pa^{233} allowed to decay. (auth)

9240 HW-60963(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRTR HAZARD ANALYSIS FOR VARIOUS MECHANICAL FAILURES. J. Murasoka. July 6, 1959. 14p. Contract AT(45-1)-1350. OTS.

Hazards associated with several mechanical failures were analyzed for the PRTR. Effects of ruptures in the 26 in. vent line and in the 4 in. drain line from the primary heat exchanger were examined along with results of a primary coolant pump shaft failure. Effects of process tube rupture were calculated together with effects of severe malfunctions in the 26 in. heat exchanger vent line or the HX-1 by-pass valve. (J.R.D.)

Research Reactors

9241 AD-215507
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A THEORETICAL AND EMPIRICAL COMPARISON OF LIGHT AND HEAVY WATER REACTORS FOR A USAF RADIATION EFFECTS FACILITY (thesis). Lawrence Albert Skantze. Mar. 1959. 59p.

Comparison was made to determine from theoretical and empirical data whether a light or heavy water reactor is more suitable for a radiation effects facility. The determination was based on flux leakage per unit power, safety of the reactor, and capital and operational costs. The design criteria and functional requirements of research reactors are examined, with emphasis on differences between these requirements and those for a radiation effects facility. Light and heavy water bare reactors, having varying parameters, are evaluated with the CBR reactor program. The results are presented in tabular and graphic form. The reactors are extrapolated to maximum permissible power to determine maximum possible leakages. Costs are compared with emphasis on quantitative comparisons. The light water reactor, operating at moderate power levels, was found superior to the heavy water reactor in fast flux leakage per unit power and in cost. (auth)

9242 AECU-4621
[General Electric Co.]. Atomic Power Equipment Dept., [San Jose, Calif.].
THE HELIUM COOLED LOOP IN THE GETR. R. F. Hausman. [1959?]. 11p. OTS.

A description of the helium cooled loop in the GETR is given. The facility is designed to irradiate the fuel specimens in a helium-cooled environment at 800°F and pressures from 315 to 400 psig. Thermal neutron fluxes in the fuel are of the order of 5×10^{13} nv and the individual test pieces, of which there are three in each facility tube, generate five kilowatts at heat fluxes slightly over 200,000 Btu per hour per square foot. Five facility tubes are provided in the reactor pool. Separate coolant lines are brought out from each facility tube to the instrumentation. The lines are then joined into one inlet and one outlet header line and are so connected to the compressors and the balance of the equipment. Axial-flow rotary compressors are used to circulate the coolant gas. Each of the facility tubes is provided with a movable cadmium neutron shutter and with suitable instrumentation and equipment to allow individual adjustment of operating conditions. (auth)

9243 INTERNUC-51
Internuclear Co., Inc., Clayton, Mo.
TEST REQUIREMENTS FOR NAVAL REACTORS AND AIRCRAFT NUCLEAR PROPULSION (GE) APPLICABILITY OF THE AETR. O. J. Elgert, T. L. Francis, M. J. Kornfeld, B. H. Leonard, Jr., and E. E. Wade. Dec. 15, 1959. 51p. Contract AT(11-1)-688. OTS.

The adaptability of the Advanced Engineering Test Reactor (AETR) to Naval Reactor (NR) test requirements on a quantitative basis is considered. A list of the NR test requirements is given. Calculations were made to deter-

mine what might be expected with different geometrical arrangements and materials relative to variations in neutron flux distribution. The advantages of the reflector control scheme in the AETR are discussed. Design changes in test loops and capsule holes to meet NR test requirements are described. (C.J.G.)

9244 NP-8350

Georgia Inst. of Tech., Atlanta. and General Nuclear Engineering Corp., Dunedin, Fla.

SAFEGUARDS REPORT FOR THE GEORGIA TECH RESEARCH REACTOR. Jan. 1960. 233p. OTS.

The Georgia Tech Research Reactor is heterogeneous, heavy water moderated and cooled, and fueled with highly enriched Al–U plates. The descriptions given include: site characteristics, the reactor containment building, the reactor, instrumentation, reactor heat dissipation systems, reactor auxillary facilities, and radiation monitoring facilities. Two-group multi-region reactor calculations were performed to determine the reactivity, flux, and power distributions for various core sizes at room temperature. Calculations are presented for: fission product reactivity loss, void and temperature coefficients, reactivity worth of beam holes, reactivity effect on reactor period, reactivity requirements, and fuel burnup and refueling cycle. The experimental facilities are described and operating procedures are discussed. Reactor hazards were evaluated relative to operating hazards, loss of coolant, effects of assumed reactivity additions, reactivity release to surrounding area, and a maximum reactivity accident. Emergency and disaster plans are discussed. (C.J.G.)

9245 ORNL-2798

Oak Ridge National Lab., Tenn.

POWER EXCURSIONS IN THE HRT. M. W. Rosenthal, S. Jaye, and M. Tobias. Feb. 29, 1960. 26p. Contract W-7405-eng-26. OTS.

During periods when the Homogeneous Reactor Test (HRT) has been operated at power, power "excursions" were observed to occur at a rate which averaged about two per hour. The occurrence of an excursion is indicated by a change in the output of the compensated ion chamber and confirmed by the response of other variables which are sensitive to power level. Excursions were observed rarely at initial core powers lower than 1 Mw; however, above 1 Mw power, the frequency of occurrence increased with power level. Excursions in which the power decreased also occurred, but at a much lower frequency, and there appears to be little correlation with power level. The power in most of the excursions rose less than 50% above its initial value, although on three occasions it increased between 100 and 150%, and on one occasion by 580%, rising from 3.7 to 25 Mw in about 8 sec. The amount of energy generated during an excursion was never so great that there was a significant pressure surge. The characteristics of the excursions suggest that they result from movement of uranium within the core, and their behavior is consistent with that of the uranium precipitation that is known to occur in the reactor. In addition to the excursions, the HRT power was found to undergo continuous "fluctuations" in which the power generally changed less than 3%, the average fluctuation size being less than 1%. The fluctuation frequency was in the range of 8 to 16 per minute. The source of the power fluctuations has not been determined, but several differences between their characteristics and those of the excursions suggest that they are not caused by the same phenomenon. A method used for estimating the reactivity associated with an excursion is described, and calculated reactivities which would correspond to various physical occurrences in the reactor are given. (auth)

9246

PLANNING AND ERECTION OF RESEARCH REACTORS (SORIN REACTOR). W. F. Ende and L. Orsoni. Atomwirtschaft 5, 17-21(1960) Jan. (In German)

The cooperation between a German planning group, the Italian customers, and the American reactor contractors in the building of the research reactor S. R. Avogadro of the SORIN is a model for overcoming the novel problems which occur in the erection and planning of such an installation. Realistic time schedules were set up by the German group on the basis of the experience which it was able to acquire with FRM in Garching. The Italian customer undertook to carry out the work in order to instruct personnel and gain experience. Time schedules and cost break-down are given. New: third core position with "large window"; arrangement of the auxiliary buildings around the reactor house. (auth)

9247

DETERMINATION OF SMALL AMOUNTS OF RADIONUCLIDES IN THE PRIMARY COOLING WATER OF JRR-1. K. Ueno (Japan Atomic Energy Research Inst., Tokyo). J. Atomic Energy Soc. Japan 1, 419-24(1959). (In Japanese)

A sample of primary cooling water taken from the stainless steel loop facility of JRR-1 on May 9, 1959, had gamma activities of about 10^{-4} μc/ml. The gamma spectrum of the sample showed peaks at 0.32, 0.51, 0.83, 1.1, and 1.3 Mev. The separation of radionuclides was done as follows: the sample solution was dried, dissolved with 11.4 N hydrochloric acid, and transferred to a Dowex 1 (H type) anion exchange resin column bed (ϕ 1cm,h 10cm, 100 to 200 mesh); the nuclides absorbed on the column were successively eluted with acid solutions of decreasing acidities (11.4, 6.0, and 3.0 N hydrochloric acid) to separate fractions of nickel, manganese, cobalt, and iron. The gamma activities of the fractions were measured with a 256 channel pulse height analyzer. The nuclides were identified by their gamma energy, chemical properties, and half lives. The results show that the radionuclides found in the sample are formed by activation of impurities and corrosive material present in the water. (auth)

9248

DETECTION OF A^{41} AND Na^{24} IN A SWIMMING POOL REACTOR. E. Petrozzi (EKCO Nucleare Italiana, Rome) and A. Vaudo (Società Ricerche Impianti Nucleari, Milan). Minerva nucleare 3, 405-13(1959) Dec. (In Italian)

A discussion of the possibility of basing the continuous monitoring of liquid and gaseous effluents upon the detection of Ar^{41} and Na^{24} of water and of Ar^{41} for air is given. The best measurement procedures are described after an examination of the detection methods and their sensitivities. (auth)

WASTE DISPOSAL AND PROCESSING

9249 NAA-SR-Memo-3649

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SURFACE WATER MONITORING FOLLOWING SEA DIS-

POSAL OPERATIONS. R. E. Alexander. Mar. 16, 1959. 22p. OTS.

Atomics International obtains disposal for radioactive wastes by sea burial to a chemical disposal area ~30 miles off the Southern California coast. The depth at this location is ~1000 fathoms. Surface water samples are obtained in the disposal area before and after each operation. These samples are analyzed for mixed fission products and for U. Quantitative measurements are obtained by β counting. (W.L.H.)

9250 ORNL-2812

Oak Ridge National Lab., Tenn.

CALCULATION OF TEMPERATURE RISE IN DEEPLY BURIED RADIOACTIVE CYLINDERS. J. J. Perona and M. E. Whatley. Feb. 25, 1960. 43p. Contract W-7405-eng-26. OTS.

Temperatures were calculated relative to the storage of radioactive solid waste as a function of time and radial distance for radioactive solid cylinders in infinite solid media of "average soil," "average rock," and salt. A resistance at the cylinder—infinite medium boundary was included in the form of an air space. For the range of parameters used and within the practical limits of accuracy, the maximum temperature rise increased linearly with the heat generation rate. The fission product spectrum was not significant in the determination of the maximum temperature rise. Under the pessimistic storage conditions assumed, the storage of cylinders of a practical size appears feasible without excessive temperature rise. A maximum temperature rise of 1000°F would be produced with an initial heat generation rate of 1300 to 1600 Btu/hr-ft^3 for cylinders with a 5-in. radius, with 350 to 450 Btu/hr-ft^3 for a 10-in. radius, and with 175 to 210 Btu/hr-ft^3 for a 15-in. radius, assuming a thermal conductivity of the radioactive cylinder of 0.1 Btu/hr-ft-°F. (auth)

9251

FEASIBILITY OF RADIOACTIVE WASTE DISPOSAL IN SHALLOW SEDIMENTARY FORMATIONS. J. Wade Watkins, F. E. Armstrong, and R. J. Heemstra (Bureau of Mines, Bartlesville, Okla.). Nuclear Sci. and Eng. 7, 133-43(1960) Feb.

General considerations pertinent to the disposal of radioactive wastes are reviewed. Suggested methods of disposal, geographical influences, and the factors pertaining to shipping liquid and solid radioactive wastes are discussed. The methods of disposing of oil-field brines are reviewed. The economics of brine injection is compared to costs of storing and estimated costs of disposing of high-level radioactive wastes. A comparison is made of the costs of drilling wells to different depths. The relative economics of drilling exploratory, injection, and monitoring wells to different depths in a disposal or test project is discussed. The geology of comparatively shallow and stratigraphically isolated sandstone lenses and shoestrings common to midcontinental United States is considered. Particular emphasis is given to the geological, engineering, and chemical information available about such formations that have proved to be productive of petroleum and have been repressured with fluids to stimulate oil production. Laboratory and field research problems pertinent to the disposal of radioactive wastes by injection are outlined. A hypothetical example is given of a pilot plant for secondary treatment and injection of dilute fission products into a shallow, lenticular sandstone formation with well-defined boundary conditions. Monitoring facilities and techniques designed to determine horizontal and vertical migration and differentiation of the migrating radioisotopes are described. A partial cost analysis is made of the pilot system. The advantages and disadvantages of a full-scale system of this type, as compared with other methods of disposal are discussed. (auth)